FEASIBILITY OF USING SPECTACLE ISLAND FOR MWRA'S MINOR RESIDUALS LANDFILL

by

Haley & Aldrich, Inc.
Cambridge, Massachusetts

for

Massachusetts Water Resources Authority
Boston, Massachusetts

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Haley & Aldrich, Inc.

Consulting
Geotechnical Engineers,
Geologists and
Hydrogeologists

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Massachusetts Water Resources Authority
Charlestown Navy Yard
100 First Street
Boston, Massachusetts 02129

Attention: Mr. Eric Buehrans

Subject: Feasibility Study
MWRA Use of Spectacle Island

Gentlemen:

We are pleased to submit 30 copies of our report entitled "Feasibility of Using Spectacle Island for MWRA's Minor Residuals Landfill.". This report has been prepared in response to a request from the MWRA Board of Directors that an evaluation be made to assess the cost and engineering feasibility of constructing a minor residuals landfill at the island site.

We have appreciated the opportunity to work with the MWRA, the MDPW and associated consultants on this most interesting project. If you have any questions, please do not hesitate to contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Wesley E. Stimpson
Senior Vice President

WES:jw/M6
Enclosure

EXECUTIVE SUMMARY

This report evaluates the feasibility of the Massachusetts Water Resources Authority (MWRA) constructing a minor residuals landfill on Spectacle Island. The report reviews available information on conditions existing at Spectacle Island in Boston Harbor. It also reviews and summarizes the current proposed use of the island by the Massachusetts Department of Public Works (MDPW) as a depository for excavated materials from the Central Artery/Third Harbor Tunnel project (CA/THT).

The MDPW proposes to use materials from the CA/THT to close out an inactive refuse landfill existing on the island and create a park for inclusion in the Boston Harbor Island State Park system. This will require that off-shore dikes be constructed and soil materials be used to fill waters of Boston Harbor.

The MWRA must have a minor residuals landfill available by 1995. For the MWRA to meet this deadline, it will be necessary for the MWRA and the MDPW to be present on the island concurrently constructing each agency's facility. The MDPW would be substantially complete with its activities by 2000. The MWRA could operate its facility to 2020 or later. This would delay the availability of the entire island for use as a park.

The study evaluates the feasibility of the landfill on the island by considering the volume capacity available on the island within the constraints established for MDPW use. The ability to operate a landfill on the island with the MDPW activities is then evaluated. Technical feasibility of construction, time for construction and costs of the landfill are also included in the feasibility assessment. Institutional issues that might also impact the MWRA's ability to meet the 1995 goal or impact the cost of meeting the goal are also reviewed.

While the study concludes that it is technically feasible to place the landfill on the island and have it in operation by 1995, various institutional issues must be addressed for the project to be viable. The preferred location will require that waters of Boston Harbor be filled. These waters are already proposed to be filled by the MDPW. If the MDPW were to fund all of the site preparation costs as part of its use of the island and the MWRA landfill resulted in minor costs associated with MDPW activities elsewhere on the island, the costs for the Spectacle Island usage are comparable slightly greater than those at MCI-Cedar Junction. If they do not, or the MDPW schedule currently proposed is not maintained, the cost could be three times those of MCI-Cedar Junction site.

Considering all factors identified as necessary to have a landfill in place on the island by 1995, the reports conclude that the proposed joint usage of Spectacle Island is not a feasible alternative to the MCI-Cedar Junction site.

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I. INTRODUCTION

1-01. BACKGROUND AND PURPOSE

In January 1989 the Massachusetts Water Resources Authority (MWRA) Board of Directors designated the MCI-Cedar Junction site in Walpole, Massachusetts as the preferred site for a minor residuals landfill. The Board also authorized the analysis of the cost and engineering feasibility to construct a minor residuals landfill on Spectacle Island with the provision that the study be completed for concurrent release with the MWRA's Final Environmental Impact Report for the Residuals Management Facilities Plan (RMFP).

The purpose of this report is to evaluate the feasibility of the joint usage of Spectacle Island by the MWRA for a minor residuals landfill and by the Massachusetts Department of Public Works (MDPW) as a depository of excavate and dredge spoil. At the present time the island is proposed to receive over 13 million cubic yards of soil and dredge materials associated with the construction of the Central Artery and Third Harbor Tunnel (CA/THT). This study examines the feasibility for these two major projects to utilize Spectacle Island concurrently for each agency's expressed purposes.

1-02. SCOPE AND AUTHORIZATION

As part of this study available information has been assembled on the physical conditions existing at Spectacle Island. A site visit was made to the island to observe present conditions. Information on the design and construction details for each agency's project was assembled and reviewed from reports prepared by the agencies. Time line requirements and construction sequencing, anticipated excavate material characteristics, delivery schedules, proposed configurations, geometries and design criteria were reviewed for each agency's landfill.

Meetings were held with both parties to confirm understandings of each agency's project. Joint meetings have also been held to review initial study results and preliminary study conclusions regarding the feasibility of the joint usage of the island. Technical feasibility has been assessed, various institutional items have been identified and cost estimates made.

Haley & Aldrich provided the MWRA a detailed study approach and work scope in response to a request for proposals from the MWRA. The MWRA provided a notice to proceed with the work on 22

March 1989. This report refines the study approach and highlights elements found to be more critical in evaluating feasibility. Critical study milestones are summarized in Appendix A.

1-03. STUDY METHODOLOGY

The study relies on having an understanding of the past historical use of the island and the present physical, subsurface and hydrogeologic conditions and the limitations they place on either proposed use. Various permits for construction were identified as they control what and when activities can take place on the island. The major goals and milestones of each design were identified, reviewed, and confirmed. Feasibility of joint usage was reviewed employing logical methodology, moving from items that could be readily documented with little question as to providing acceptable joint use to items that could be considered to be subjective with no clear answer.

Items reviewed included assessing volume available within the MDPW design criteria for the island; MWRA landfill location and configuration within that volume to allow time for the development of the landfill and operation without unduly hindering MDPW use; assessing special, extraordinary site preparation measures; review of construction timing; review of joint contractor interaction and reliance; and documentation of contingency items and project costs based on various assumptions.

1-04. REPORT ORGANIZATION

Sections II, III, IV, and V of the report present the study assumptions and provide data on the conditions existing at Spectacle Island, the proposed MDPW program for the island, the MWRA landfill needs and the conditions related to the existing refuse landfill on the island. Section VI evaluates the feasibility of the independent use of the island by the MWRA as a base line for the construction and time feasibility evaluation. Criteria to assess joint usage are also discussed.

Section VII reviews various alternatives and proposes a conceptual feasible alternative subjectively judged to minimize MWRA landfill development costs. Section VIII addresses institutional issues related with the joint usage of the island and Section IX presents the study conclusions. An executive summary is provided at the beginning of the report and provides an overview of the study approach and conclusions.

1-05. REFERENCE DATUM

Elevations in this report are in feet and refer to the MDPW project datum for Spectacle Island which is defined as mean sea level equal to El. 100.

II. SPECTACLE ISLAND

2-01. HISTORICAL BACKGROUND

Spectacle Island is one of thirty islands situated in the Boston Harbor. As shown on Figure 1, it is located east of Thompson Island and west of Long Island in the southern portion of Boston Harbor. Topographically, the island is dominated by two drumlins created by the glacial deposition of sands, gravels and inorganic silts ("till"). These drumlins are joined by a sandbar of clay soil which has been covered by refuse.

The island has a long history of commercial use. Between 1912 and 1930, the island was a site for a garbage reclamation operation, which incinerated domestic waste to produce grease for soap manufacturing. From 1930 to 1960, the island was used as a landfill disposal area for the City of Boston. The use of the island as a municipal landfill has altered the original topography considerably. Refuse was burned and then buried atop the sandbar, resulting in up to 85 feet of refuse being present in the central portion of the island. Presently, there is no commercial activity occurring on the island. The island was included in the Boston Harbor Island State Park System by the legislature through Ch. 742 of the Acts of 1970 and is under the land use and environmental protections of the Act although there is no sanctioned public access at present.

2-02. PRESENT PHYSICAL CONDITIONS

The present day Spectacle Island (Figure 2) is approximately 96 acres of land area. The two drumlins, which rise to heights of 95 and 65 feet above mean sea level to the north and south, respectively. The till material comprising the two drumlins is characterized as being a poorly-sorted mixture of dense, compact sands, gravels and silts.

The old City of Boston landfill lies atop a low lying sandbar and occupies approximately 40 percent of the land area and varies in depth from 15 to 85 feet. The landfill material was loosely placed and is reportedly consolidating under its own weight. As indicated on Figure 2, along the eastern shore of the island, the refuse is exposed to reveal a near vertical slope. The effect of storms, tides and wave action has led to the progressive deterioration and exposure of the landfill materials on the east side. Similar conditions exist on the western side of the island, although the refuse slope is inland a short distance.

III. PROPOSED MDPW ISLAND USAGE

3-01. INTRODUCTION

The MDPW plans to excavate and dredge approximately 13.5 million cubic yards of material from the CA/THT Project. The material will be transported to the following locations: 1) the Foul Area Disposal Site (FADS), an ocean disposal site located approximately 20 miles northeast of Boston, and 2) a landfill or containment facility to be sited and developed on Spectacle Island, located in Boston Harbor. This section summarizes the plans detailed in Chapter 9 of "The Supportive Engineering Report" prepared by Bechtel/Parsons Brinkerhoff for the MDPW, plus supplemental backup data provided.

The EPA is currently performing an Environmental Impact Study on the FADS. The amount of material that will be disposed on Spectacle Island is dependent upon the volume that will be permitted by the EPA to go to the FADS for ocean disposal. At one time, two configurations were proposed for Spectacle Island use by the MDPW. As of this report, one configuration has been selected, previously known as the "Containment" configuration.

Based on MDPW current estimates, the volume of material to be deposited on Spectacle Island could be as much as 13.5 million cubic yards. The MDPW has prepared conceptual filling and grading plans to accommodate this volume of fill on the island. This will necessitate constructing rock containment dikes beyond the presently existing shoreline and filling in portions of Boston Harbor.

Expansion of the island is limited by the engineering properties of the foundation materials located off-shore around the island. The MDPW has established that the containment area will be inboard of the 10-ft. isopach of soft sediments. In addition, numerous environmental agencies encouraged the MDPW to limit disturbance of marine life by minimizing the amount of fill placed around the island perimeter. Also, because of the proximity of Spectacle Island to Logan Airport, the Federal Aviation Administration (FAA) has suggested a limit to the island height of 145 ft. above mean sea level (MSL), or El. 245, project datum.

To satisfy the federal requirements that parklands not be disturbed to construct federal highways, the MDPW proposes that the island expansion be completed as a public park. In addition to accomplishing the closure of a landfill which continues to discharge refuse and leachate into Boston Harbor, the filling of

the island to a configuration designed to maintain the "Spectacle" identity of two distinct drumlins will provide the Massachusetts Department of Environmental Management (MDEM) a park that can be incorporated as an active addition to the Boston Harbor Island State Park System.

3-02. EXCAVATION MATERIAL CHARACTERISTICS

A total of 13.5 million cubic yards of material is associated with the MDPW project, of which 12.1 million cubic yards are to be removed by excavation and 1.4 million cubic yards are to be removed by dredging (dredged material). Table I shows a breakdown of total excavation and dredged materials classified according to the estimated amount of contaminants present. Categories I and II are acceptable for ocean disposal and Category III is unacceptable for ocean disposal. The in-place fill at Spectacle Island is expected to be a blend of the excavated materials due in part to the multiple handling requirements to haul the material from the excavation, place onto barges for transport to the Island, and finally off load and haul for placement. Attempts will be made to separate the major amounts of clay that will be excavated.

Based on preliminary studies, the soils excavated are anticipated to consist of 36 percent fills, 3 percent sands and gravels, 12 percent cohesive organic soils, 35 percent clays and 13 percent glacial tills. The overall characteristic of the soil when mixed together is anticipated to be more like a cohesive material than a granular material.

3-03. PROPOSED ISLAND GEOMETRY

The 13.5 million cubic yards assumes only acceptable dredged material (Categories I and II) and dredged rock will be deposited at the FADS and all excavate and unacceptable dredged material (Category III) will be deposited on the island. The 13.5 million cubic yards represents the in-place volume at Spectacle Island of the 12.1 million cubic yards now in place at the CA/THT project site.

As shown on Figure 3, the placement of material on Spectacle Island will require the construction of rock containment dikes off-shore from the existing island. The island will increase in size from an existing 96 acres to approximately 215 acres. New material will cover the entire island with the exception of the southern end. The peaks of the north and south drumlins will be

raised approximately 45 ft. and 25 ft., respectively. Maximum side slopes of 5 H(horizontal) to 1 V(vertical) are proposed for the material placed on the island.

3-04. MATERIAL HANDLING

Material from the CA/THT will be transported to the island by barge. Daily deliveries will begin in mid 1991 and continue for approximately 8 years with peak activity from 2 to 4 years into the project. Table II shows the approximate number of estimated daily barge deliveries and quantities of material to be delivered to the island.

The MDPW is considering two types of barge unloading facilities located at the southwestern end of the island. One type is a "link span", pontoon-supported floating facility. This type allows loaders and trucks to drive directly onto the barge deck. Ramps connect the barge to the facility and the facility to the shore. Each "link span" accommodates two barges. At least four "link spans" will be required.

The second type of unloading facility is a fixed-type, pile-supported marginal wharf oriented parallel to the shoreline. Portal cranes on wheels would be used for unloading each barge. The wharf will be long enough to accommodate seven barges.

3-05. CONSTRUCTION METHODOLOGY

Each of the major construction activities necessary to allow placement of excavate materials on the island has been reviewed by the MDPW. A significant and unique earth moving effort will be required. Table III indicates the anticipated equipment and manpower requirements. The major components are discussed in more detail in this section.

3-05.1 Containment Dike

A containment dike is proposed to encircle most of the existing island with the exception of the southern end. Figure 3 shows the proposed dike location. The dike is proposed to be a conventional rubble mound breakwater dike with outboard slopes of 2H:1V. Slopes 6H:1V will be used in some areas to allow recreational boat access to the island. The core material consists of small stone with an outboard 2 to 6 ton stone cover. The top of the dike will be at El. 114, approximately

9.5 ft. above mean high water. A 28 ft. crest width at the core level will be provided for use as a haul road for handling the excavated material.

3-05.2 Material Placement

The excavate is proposed to be transported by truck from the unloading facility along the dike and end dumped inboard to the existing shoreline. Because of the anticipated nature of materials from the CA/THT Project, stockpiling, site mixing and blending will be required to optimize material placement. Final locations for temporary stockpiling and mixing areas will be determined by the contractor during placement. The proposed in-place density for material placed above the tide level is 85 to 90 percent of maximum density as measured per ASTM D-1557 which will require some systematic placement and compaction procedures.

3-05.3 Final Cap

Final capping for the containment facility is proposed as the landfill reaches final elevations. The cap will be constructed in accordance with the following Massachusetts Department of Environmental Quality Engineering (DEQE) requirements:

- minimum 12 inches of soil with a permeability $\leq 10^{-7}$ cm/sec
- minimum 6 inch sand drain layer with permeability $\geq 10^{-3}$ cm/sec
- minimum 6 inches topsoil
- slopes between 3 and 30 percent.

The cap will connect to a cut-off wall or naturally existing low permeability clay or till layer.

If sufficient capping material is not available from the CA/THT project, the following three possible sources may be employed:

1. Excavate the glacial till materials that make up the south drumlin of the island.
2. Transport off-site capping materials from borrow areas on the mainland.
3. Use a man-made high density polyethylene or similar liner.

3-05.4 Leachate Collection System

A leachate collection system may need to be installed around the inboard perimeter of the dike. The system would consist of perforated or porous wall drainage pipes surrounded by a gravel backfill. The leachate would be routed to a treatment facility prior to discharge into the harbor.

3-05.5 Cut-Off Wall

A slurry-type, cut-off wall may be installed to prevent contaminated leachate from passing through the containment dike and into the harbor. The wall would be located approximately 95 ft. inboard of the containment dike and may extend into areas with no dike. The top of the wall will connect to the low permeability "cap" layer and the bottom of the wall will extend into the clay or glacial till layer.

3-05.6 Final Use

The MDPW must restore the site to public park usage. The park would be part of the MDEM "Boston Harbor Islands State Park 1984 Master Plan." The MDPW filling program has been configured to allow the island to be used for this purpose.

3-06. PROPOSED CONSTRUCTION SCHEDULE

Construction on the island will begin by modifying existing grades, constructing unloading facilities, and dredging and constructing the rock containment dike on the east side. Before the end of the first year, material placement and compaction of excavate and dredged materials will begin on the island and inboard of the east dike.

Material placement and compaction will continue to the final contours for the duration of project. The final stages of activity will involve placing the final cap, installing a leachate drainage and venting system, and constructing a cut-off wall at the required areas. An approximate construction time line is shown in Figure 4. The final activity schedule will be left to the contractor to determine prior to and during construction.

The MDPW plans to cover or "cap" the existing landfill in conjunction with material placement. No separate plans have been made to contain the eroded slopes of the existing landfill prior to construction activity on the island. The MDPW will construct a public park on the island once construction of the containment facility is complete, currently estimated to be about the year 2000.

3-07. PERMIT REQUIREMENTS

The use of Spectacle Island as a depository of fill materials from the CA/THT project will require obtaining numerous regulatory permits. Many of the studies necessary to obtain these permits have been completed or are underway. Several permits require approval by State and Federal agencies. Table IV lists the permits deemed necessary to develop the island as proposed.

3-08. INSTITUTIONAL ISSUES

In order for the MDPW to use Spectacle Island for the deposition of excavate and dredge spoil the island must be made available for public use as parkland shortly after the filling of the site is complete. Use of the island by the MDPW will require action or approval by the City of Boston, the MDEM and possibly the state legislature. The MDEM and the City of Boston would provide the island to the MDPW for the purpose of having the existing landfill closed and the island site restored for use as a public recreational area as part of the Boston Harbor Island State Park System.

Environmental studies are currently underway to evaluate island use and development as a park. Conversations with permitting agencies as to the allowable area of open water that can be filled have assumed the island's ultimate use is the creation of a park. Funding from the U.S. Department of Transportation for the federal share of the island development requires that the use of the island as parkland be maintained.

IV. MWRA LANDFILL REQUIREMENTS

4-01. INTRODUCTION

Under the MWRA's Residuals Management Facilities Plan (RMFP), wastewater from 43 cities and towns serviced by the Authority will be treated at a secondary treatment plant at Deer Island beginning in 1995. In order to support operations at Deer Island, ancillary facilities are required through which the digested sludge can be removed economically and safely. The current plan calls for the construction of a heat drying/pelletizing facility and a composting facility at the Fore River Staging Area (FRSA) to handle the digested sludge and a secure landfill at the MCI-Cedar Junction site. The landfill will handle minor residuals and will serve as a contingency/emergency backup facility for dewatered sludge and/or pellets and compost produced at the FRSA and which are not successfully distributed.

The end product of the heat drying facility is a pelletized fertilizer which can be marketed for reuse. Approximately two-thirds of the digested sludge produced at Deer Island will be heat dried and made into pellets. The remaining one-third will undergo composting whereby the digested sludge is mixed with an amendment such as sawdust or woodchips and then aerated. The compost product can be marketed for reuse as a soil amendment product.

Minor residuals are by-products of the wastewater treatment process and include "grit" and "screenings". Screenings are the floating debris which are collected at various headworks and CSO facilities and throughout the sewerage collection system. Grit consists of coarse, heavy solids which typically settle out when the velocity of the raw sewage is reduced. The grit is collected at the headworks throughout the system including at Deer Island and Nut Island. The most economical and expedient means of dealing with the minor residuals is to place them in a secure landfill. Design criteria summarized in the following sections have been based on information available in the RMFP.

4-02. FUNCTIONAL REQUIREMENTS

The strict schedule of the federal court order governing the Boston Harbor Cleanup results in the need for the landfill to be operational by 31 August 1995. In accordance with the RMFP the service life of the residuals, including the landfill, has

focused on a minimum twenty-four year planning period from 1995 through the year 2020.

The Authority has determined that the minor residuals landfill must:

1. Accommodate disposal of the minor residuals (grit and screenings) collected within the MWRA service area for the entire 24-year planning period (1995-2020).

2. Serve as an emergency backup to the main residuals management processing facilities during the planning period.

The landfill emergency backup capacity must be large enough to handle unscheduled emergency occurrences which could take place during the planning period. These occurrences can take the form of truck deliveries of pellets to the landfill as a result of unsuccessful marketing or distribution of the product. Other extreme emergency occurrences resulting in dewatered sludge deliveries to the landfill could be caused by major mechanical failures at the pelletizing and compost facilities.

Table V provides the estimated volume requirements of the Spectacle Island landfill. The total landfill volume of 3.2 million cubic yards is identical to the MCI-Cedar Junction landfill capacity.

4-03. GENERAL CHARACTERISTICS AND CONSTRUCTION PROCEDURES

4-03.1 Secure Landfill

A secure landfill designed to comply with the Division of Water Pollution Control requirements will be needed to contain the disposed sanitary waste materials so as to prevent the contamination of the underlying soil and groundwater. The landfill characteristics include containment berms, a double liner leachate collection system and liners and caps. For the purposes of this study, the secure landfill system described in this section has been assumed to be constructed at Spectacle Island.

The containment berms allow for the vertical expansion of the landfill as they provide structural stability to the landfill. Berms are basically earth embankments which have low permeability barrier ($k \leq 10^{-7}$ cm/sec). The double liner leachate collection system serves as protective containment at the base of the landfill to prevent the spread of leachate from the landfill.

A daily liner, or cover, consisting of no less than six-inches of earth fill must be placed atop the sanitary waste at the end of each day's activity. The purpose of the daily cover is to contain odors habitually associated with a landfill, to prevent animals, birds and vectors from disturbing the landfill and to provide a temporary seal from the weather. When the landfill or a section thereof is to be inoperable for a period of time, an intermediate liner of at least an additional six-inches of earth fill is required.

When a portion of the landfill is to be closed permanently, a final liner, or cap, is required. The capping system consists of three distinct layers as shown on Figure 5. The cap itself is constructed atop the last daily or intermediate liner. A low permeability soil ($k \leq 10^{-7}$ cm/sec) at least twelve inches thick comprises the cap. Then, a twelve inch minimum sand drainage layer is installed atop the cap to allow infiltrating water to drain off rather than penetrate the cap. Finally, up to two feet of topsoil completes the final liner system. To prevent the migration of the small size soil particles from the topsoil into the sand drain, where they might decrease the layer's permeability, a filter fabric (geotextile) separates the topsoil from the sand drainage layer.

4-03.2 Composite Liner System

The function of the composite liner system is to inhibit the flow of leachate into the groundwater or the subsoil thereby restricting the limits of the contamination to within the confines of the landfill. The composite system derives its name from combining low permeability soil ($k \leq 10^{-7}$ cm/sec) with a synthetic membrane. The two liners complement one another in that the synthetic membrane is typically less permeable, but has no self-healing characteristics; while the natural, soil liner possesses a self-healing capability but is slightly more permeable.

The proposed MWRA composite liner system is depicted in Figure 5. The natural liner material is proposed to be placed atop the natural soil to a thickness of at least 12 inches. A double liner is created when a sand drainage layer (18 inches thick) is used to separate the natural liner from the synthetic liner. A 60 mil. synthetic liner (membrane) is proposed for the landfill. A second sand drainage liner (18 inches thick) then separates the landfill material from the liners.

The sand drainage layers will be designed to serve as leachate collection systems. Collection pipes will carry the leachate to sumps or manholes from whence the collected leachate can be

pumped or otherwise removed for treatment or disposal. The primary collection system is in the uppermost sand drainage layer. The secondary collection system is the sand drainage layer between the two liners.

The landfill will be developed in phases. Each phase will have its own composite liner and leachate collection system which can be integrated into a more sophisticated, final system. The estimated average leachate flow rate from each phase based on production rates provided in the RMFP is roughly 9000 gallons per day. The liner would typically be installed following subsoil stabilization and berm construction.

4-03.3 Marine Facilities

For a landfill location on Spectacle Island, marine docking and unloading facilities will be required during both the construction and operational stages of the landfill. Barge unloading options include facilities that allow for roll-on, roll-off vehicular loading where trucks drive directly on and off the barge via ramps. The wharf option would use a crane operating to unload barge material onto waiting trucks. Large loads would be handled by the wharf option. Both options require a minimum of twelve feet of free draft.

It has been assumed that an average of 50 cubic yards of grit and screenings and 800 cubic yards of digested sludge could be delivered daily to the facility based on quantity estimates used for MCI-Cedar Junction studies.

4-04. SCHEDULES

The landfill must be operational by 31 August 1995 to comply with the court mandated schedule. Conceptually, the landfill will be constructed in five phases. During each phase, approximately one-fifth the total spatial area of the landfill will be developed. Each phase will be capable of fulfilling its dual role of providing contingency backup space as well as serving as an active landfill for minor residuals. Volume requirements of the Phase I cell are provided in Table V.

4-05. PERMIT REQUIREMENTS

The development of Spectacle Island as a landfill for minor residuals and contingency backup materials requires regulatory licensing. Several of the permits require approval by another state or federal agency, but can be submitted concurrently; with

final approval contingent upon approval by that state or federal agency.

The permits and/or licenses required for Spectacle Island fall into two broad categories. The first deals with the siting of a landfill on the island while the second category involves issues dealing with the construction of marine terminal facilities. Table VI lists the required permits for the MWRA. It is assumed that permits associated with the MDPW development of the island will be obtained by the MDPW.

V. EXISTING LANDFILL

5-01. SUMMARY OF KNOWN CONDITIONS

The existing refuse landfill on Spectacle Island is most likely the end product of three operations. Circa 1860, the island was the site of a horse rendering business which processed dead animals to produce hides, hair, bones and glue stock. By 1912, this business was replaced by one which incinerated Boston garbage then compressed it to remove grease for soap manufacturing. Like the horse rendering business before it, the grease reclamation venture eventually failed. However, Spectacle Island continued to be a city disposal site until about 1960.

Presently, the landfill covers an approximately 38-acre area. Underground smoldering and spontaneous combustion have occurred in the past. Physical examination of the island reveals that no efforts were made to cover the refuse which is at or just below the ground surface. The composition of the refuse includes glass, bricks, wood, paper, rubber, metal as well as old bones.

5-02. SUITABILITY AS FOUNDATION FOR MWRA LANDFILL

The refuse was placed uncompacted atop a clay stratum to heights of 85 feet. The loose, varied material contains voids which would collapse and compact if loaded.

In its present state, the landfill is unsuitable as a foundation. Were a minor residuals landfill to be located atop the unstabilized refuse landfill, differential settlement could result in damage to the liners and malfunctioning of the leachate collection pipes. Stabilization requirements for the refuse are outlined below.

5-03. REGULATORY REQUIREMENTS

Regulations of the Division of Solid Waste (DSW) of the DEQE require the specific closure of the existing refuse landfill. Closure requires that the existing refuse be encapsulated to contain the refuse and prevent leachate therein from polluting the underlying soils and groundwater. In addition, systematic collection and treatment or containment of leachate currently being generated by the landfill may be required. The DSW is responsible for issuing the landfill closure permit, often referred to as a "permit to construct."

The use of the island by the MDPW will result in the MDPW assuming the responsibility and costs of closing the existing refuse landfill. If the MWRA were to use the island independently of the MDPW, the MWRA would assume the costs and liabilities of closing the existing landfill.

VI. EVALUATION OF MWRA USE OF SPECTACLE ISLAND: GENERAL CONDITIONS

6-01. INTRODUCTION

This section evaluates the parameters under which a minor residuals landfill may be constructed on Spectacle Island. Initially, independent usage of the island is analyzed to determine whether the MWRA could construct a landfill uninhibited by the competing interests of the MDPW. Then, joint usage of the island is examined to establish feasibility parameters for development of a landfill on the island with MDPW activities. The joint usage parameters outlined in this section will serve as an introduction to the more detailed assessments found in Section VII.

6-02. INDEPENDENT USAGE

Independent placement of a minor residuals landfill on Spectacle Island will require that the MWRA take steps necessary to close the existing landfill, comply with the FAA's island height restrictions, and avoid disturbing the natural and historical features of the south drumlin. The landfill could be placed on the island if it principally covered the central and northern portions of the island as shown on Figure 6. Final landfill grading could be accomplished as shown on Figure 7, with slopes no greater than 5H:1V and heights below FAA restrictions. The relative components of the landfill and grading are shown on Figures 8 and 9. Pier facilities could be located at the southwestern corner which requires less dredging and better protection from adverse weather than most other sites.

Construction of the facility would take place in five phases with each phase constructed to satisfy future demands and needs. Construction sequencing would involve developing the pier/wharf area, constructing perimeter dikes to allow the existing refuse landfill to be closed, closing and stabilizing the existing refuse landfill, providing vehicular access to the site, providing utility services, and initial site development of the Phase I cell. Initial site development includes preparing a containment berm and grading the site to receive a double liner leachate collection system in a seven-acre area as shown on Figure 6.

Activities to close out the existing landfill and prepare the island for construction of the MWRA landfill include:

1. Construction of an on-shore perimeter containment dike.

2. Shaping and grading of the refuse material to provide a level site for liner construction.

3. Stabilization of the existing refuse material by dynamic compaction.

4. Construction of an interim landfill cap to control infiltration until final capping is provided as part of the operation of the MWRA landfill.

Figure 10 depicts the construction schedule associated with independent usage. As the figure illustrates, much of the time and effort required in the Phase I cell development goes to closing the existing landfill.

It is assumed that the contractor will be able to make unrestricted use of north drumlin till material. It is further assumed that this material will be suitable for general fill and surcharging, daily and intermediate cover of the residuals, bulking, and, if blended with bentonite, as an acceptable liner material for the double liner. The till would not be suitable for the sand drainage layers and accordingly materials must be imported from an off-island source.

Construction scheduling would involve ensuring that the landfill is operational by the 31 August 1995 deadline. Interim or temporary fixtures may be constructed in Phase I, if time becomes critical. Examples of temporary fixtures are portable latrine facilities, portable generators, relocatable trailers and water purification units. For this scenario, Phase I construction would need to commence on 1 March 1993.

Preparing the foundation would involve stabilizing the existing refuse landfill so as to prevent detrimental differential settlement which would cause the leachate collection system to operate poorly. Dynamic compaction, surcharging, or a combination of the two should satisfy this requirement. Dynamic compaction involves impacting a heavy weight onto the refuse causing voids to collapse and compress, thereby densifying the land mass. Surcharging relies on placing a quantity of soil atop an area to be densified and allowing the voids to compress over a period of time. As the existing refuse landfill must be completely closed during Phase I, dynamic compaction would be faster, thus the preferable alternative. Final cover materials for the MWRA landfill would have to be imported onto the island over the course of its operation.

6-03. REQUIREMENTS FOR MARINE TERMINAL FACILITIES

6-03.1 Spectacle Island Facilities

The need to routinely handle small volumes of residuals and at certain times, during an emergency, to handle larger volumes of other residuals suggests the use of marine facilities that combine the roll-on, roll-off barge delivery with a fixed wharf capability. For the purposes of this study, a single facility consisting of a 165 foot long pier oriented perpendicular to the shore, serviced by a crane has been assumed. The crane will off-load construction material and any barged, emergency sludge which reaches the island. Fitted at the end of the pier could be a ramp which can be raised and lowered onto barges delivering trucks hauling grit and screenings. As there will only be four trucks arriving daily under non-emergency conditions, it is believed that roll-on, roll-off is the most economical means of transporting the minor residuals. Under emergency conditions, the sludge would most economically be delivered in bulk on a barge and a dedicated crane would be required to unload the high volume barges. Sufficient trucks would be necessary to haul the material to the landfill.

6-03.2 Mainland Facilities

Barge loading facilities will be required during the construction and operational phases of the landfill planning period. Loading facilities may require a sophisticated wharf-crane operation or merely an access ramp to permit roll-on, roll-off loading. It is beyond the scope of this study to assess facilities required off the island. It would be necessary to conduct a study to determine the best means to transport construction materials, minor residuals and sludge to the island and from whence they should originate if the island is selected as the preferred disposal site.

6-04. JOINT USAGE CONSIDERATIONS

6-04.1 General

In order for the MWRA to locate its residuals landfill on Spectacle Island with the MDPW developing the island with material from the CA/THT, it will be necessary to derive a landfill location and configuration that satisfies the following criteria:

1. A grading plan is necessary to allow the site to be filled within the criteria established by the MDPW.

2. The joint usage plan must allow the MWRA to develop its landfill in a manner that does not detrimentally impact the MDPW use of the island, while allowing the MWRA to operate efficiently.

3. The landfill must be constructable in the location selected.

4. The landfill must be developed in a timely fashion to meet the established deadline.

5. The work must be phased so that simultaneous construction by the MWRA and the MDPW can occur.

Each of these items provide the basis for the assessment of the feasibility of joint usage of the island. Each item is discussed in general in more detail below. In addition, a variety of institutional issues must be successfully resolved to make the joint usage feasible. These issues are discussed in Section VIII.

6-04.2 Volume Considerations

The MDPW proposes placing 13.5 million cubic yards (in place) of material on the island. Joint usage would add 3.2 million cubic yards to account for the minor residuals landfill. In evaluating the feasibility of placing this additional volume on the island, it was assumed that:

1. Perimeter dike locations proposed by the MDPW would be used.

2. Side slopes would be 5H:1V or flatter per the MDPW design criteria.

3. The south drumlin is to remain in its natural state.

4. The FAA height restriction of El. 245 is to be observed.

6-04.3 Landfill Locations and Configurations

Having established that sufficient volume exists on the island, it is necessary to select a landfill site within the proposed joint usage grading plan. A number of factors need to be considered in making this selection including:

1. The site selected must have sufficient volume capacity to handle the MWRA's demands.

2. The site should be located to minimize contractor interaction and provide for concurrent, independent

construction that could be undertaken during MDPW's peak usage period.

3. To the greatest extent possible, the site selected should require minimal foundation stabilization.

4. The site should be accessible for both ease of construction and later landfill operations to minimize costs.

6-04.4 Foundation Preparation

Prior to developing any secure landfill, the foundation must be properly stabilized to prevent a slope failure or unacceptable differential settlement. The landfill could be placed atop one of three island features: the north drumlin, the existing refuse landfill, or newly-placed, off-shore fill. Only the north drumlin offers a foundation assumed suitable for a landfill with no extraordinary work. The refuse landfill is highly compressible and, due to the varied nature of the refuse, will require some form of compactive effort to minimize differential settlement. Smoldering fires may also need to be extinguished. Similarly, the off-shore fill must either be placed as a controlled, structural fill or must be stabilized subsequent to landfill construction.

Depending on where the landfill is sited, any one or a combination of methods may be necessary to stabilize the foundation materials. Methods available include singular or joint use of earth surcharges, dynamic compaction, vibratory compaction, and accelerated drainage systems to consolidate and densify off-shore fill materials and on-shore refuse.

6-04.5 Required Time for Construction

For the purposes of this study, construction time is important as it impacts on the ability of the Phase I MWRA landfill to be operational by the required date. As such, it is assumed that constructing the Phase I area is of paramount importance; but that additional phase development, which will occur well after MDPW has concluded its peak island usage, is of lesser concern.

Initial landfill development may have any or all of the following elements that may impact the time necessary for construction:

1. Construction of a containment dike along the perimeter of the expanded island.

2. Filling behind the dike.

3. Stabilizing the newly placed fill, existing refuse fill, and/or the existing off-shore sediments located within the diked area.

4. Constructing a cut-off wall.

5. Constructing a containment berm for the new landfill.

6. Constructing a double liner to secure the new facility.

In addition, a wharf facility or pier, support facilities, roads and utility services are required to support construction and operation of the landfill.

6-04.6 Construction Phasing with MDPW

Various levels of MDPW assistance can be assumed for joint usage of the island, ranging from limited to full. Two extremes have been assumed for this study. The first assumes limited assistance. The MWRA, therefore, must perform all of the tasks mentioned above for the Phase I cell. However, for future phases, the perimeter dike, filling behind the dike, foundation stabilization and cut-off wall construction could be completed by the MDPW with less time pressure.

Concurrent construction by both agencies would require that unloading facilities for the MWRA be located at least some distance from the MDPW barge unloading area. The southwestern corner of the island is the preferable location for both agencies' piers or wharves.

The second extreme, full assistance by the MDPW, could mean that the MDPW constructs required perimeter dikes in a manner fitting the MWRA schedules, fills behind the dike, stabilizes the existing refuse, off-shore sediments and new fills, and stockpiles suitable construction, cover and liner material for use at the MWRA landfill. A pier or wharf facility is still required, however co-location at the southwestern corner of the island may be feasible.

VII. EVALUATION OF MWRA JOINT USE OF ISLAND

7-01. FEASIBILITY ASSESSMENT

The MDPW will place 13.5 million cubic yards of excavated and dredged materials from the CA/THT project on Spectacle Island. The material would be placed inboard of a newly constructed containment dike which encircles all of the existing island with the exception of the southern end. In some areas, the dike would extend up to 1200 ft. from the existing shoreline. Material would be placed within the dike boundaries to final grades and slopes not exceeding 5H:1V and graded to retain the island's "spectacle" appearance, while leaving the south drumlin in its natural state. Because of the island's proximity to Logan Airport, the FAA imposed the fill height limitation to El. 245 or 145 ft. above MSL. A final contour plan proposed by the MDPW accommodating the 13.5 million cubic yards is shown in Figure 3.

The proposed minor residuals landfill for the MWRA requires a volume of 3.2 million cubic yards including the volume consumed by the berms, the double liner system, and the daily, intermediate and final covers. The landfill will be divided into five cells with each cell, approximately 600,000 cubic yards, developed in one of five construction phases.

An evaluation was conducted to examine the possibility for having both the MDPW's 13.5 million cubic yards disposal facility on the island along with the MWRA's 3.2 million cubic yards minor residuals landfill. Figure 11 shows a proposed final contour plan for joint usage placing 16.7 million cubic yards of material on the island. This final contour plan was created with the intention of causing minimal changes with the MDPW's proposed plans. The following MDPW criteria have been met:

1. Materials remain within the containment dikes constructed at the perimeter of the expanded island.

2. Final slopes are at or flatter than 5H:1V.

3. Fill height limitation of El. 245 imposed by the FAA exists.

4. South drumlin remains.

While making minimal changes to outside slopes and grades, the major alteration in island configuration occurred in the central

area. Filling in this area resulted in a gradual grade increase from the south to north drumlins thus removing the "spectacle" appearance proposed by the MDPW. The maximum increase in fill thickness above the MDPW's proposed plans would be approximately 60 ft. located at the central area of the island. A cross-section in the north-south direction is presented in Figure 12.

After analyzing several possible locations for the MWRA's minor residuals landfill, an area in the northwest corner of the proposed final island configuration was selected. Figure 13 shows the locations for the full facility and the Phase 1 facility. The full facility will occupy approximately 60 acres while the Phase 1 facility will occupy approximately 12 of the 60 acres. Although this area could be moved to other similar outboard locations on the island, the preferred location was selected for the following reasons:

1. It causes the least interference with the MDPW's construction activities.

2. The facility would not penetrate into the existing refuse fill.

3. The location provides easy access to the north drumlin till materials.

4. Being on the west side, the island would act as a shelter to the high waves and adverse weather conditions that sometimes exist on the east.

5. The location is close to the beginning of the MDPW's proposed containment dike on the west side.

6. The location is on the west side of the island relatively close to the preferred location of the wharf unloading facility.

In order for the full facility to be constructed at this location, the MWRA would require that the MDPW dispose its material to the contours shown in Figure 13. By using this location and revised MDPW island configuration, the MWRA's material can be placed against the fill material left by the MDPW. This would eliminate the need for approximately half the berms that the MWRA would otherwise require for landfill containment and stability. A cross-section of the full facility showing existing and final grading is shown in Figure 14.

Two other alternate locations were evaluated:

1. Placing the landfill area in the northeast corner of the island.

2. Placing the full facility within the boundaries of the existing island.

The main reason for rejecting the first alternate was that the location would require transporting materials and equipment diagonally across the island or along a lengthy perimeter route. This would lead to a significant increase in interference with the MDPW's activities. Moving the unloading facility to this area was also considered. However, the move would not be practical because of the extra costs, and more severe weather conditions on the east side of the island. Also, the perimeter dike was furthest from the existing shore and the majority of the MDPW's material is proposed to be placed in this area.

With respect to the second, any alternative that involves construction of the MWRA landfill on the presently existing island would not allow the MDPW to place the volume of material it needs to place within the construction time for the CA/THT. In addition, the alternative would involve excavating into the existing refuse and occupying most of the south drumlin. This alternative was rejected because of the impacts on the MDPW use of the island, significant additional costs and potential problems associated with penetrating into and constructing upon a major portion of the existing refuse.

7-02. CONSTRUCTION PHASING WITH MDPW

7-02.1 Construction Sequencing and Foundation Preparation

To meet the MWRA schedule with the selected landfill location, it will be necessary to construct certain portions of the facility in a timely manner. The selected location requires the following construction activities:

1. Construction of the perimeter containment dike from the west shore to the end of Phase I and return to shore.

2. Placement of fill behind the dike to El. 110 within the Phase I construction area.

3. Stabilization of the newly placed fill and any soft underlying sediments present.

4. Construction of a cut-off wall.

5. Construction of landfill berms.

6. Construction of the double liner system to create a secure landfill facility.

Evaluation of the requirements to stabilize the fill material placed between the dike and the existing shoreline and the off-shore sediments has lead to the conclusion that treatment with a temporary earth surcharge would be sufficient. For satisfactory liner performance it is important that any settlement that might result in differential movement of the liner system after construction be eliminated. Long term, non-differential settlement is not as critical and settlement allowances can be incorporated into the design. Temporary earth surcharges can provide the initial mechanical settlement desired to remove potential soft spots that might cause differential settlement of the final liner system and consolidate off-shore sediments.

Earth surcharging could be accomplished by over-filling above El. 110 in a portion of the landfill area and allowing the material to remain in place for a period of time. After sufficient time, the over-fill material could be cut to final grade at El. 110 and moved to another recently filled area behind the dike to be restockpiled. This "moving" surcharge process could be continued until necessary stabilization of the foundation soils below El. 110 had been achieved throughout the landfill area.

7-02.2 MDPW Assistance to MWRA

Two working scenarios are available in relation to construction phasing for joint usage of the island by the MWRA and MDPW: landfill development with little reliance on the MDPW and full assistance by the MDPW.

The "independent" first scenario could arise because of delays with the MDPW's activities or for contractual reasons or because of failure to successfully resolve the various institutional issues identified in Section VIII needed for cooperative development. Under this scenario, it is assumed the MWRA would be responsible for providing the following items:

1. Permanent pier or wharf facility.

2. Utilities to Moon Island by underwater trenching (water, electricity, sewer, and telephone).

3. The containment dike, filling and stabilizing materials inboard of dike up to El. 110, and installation of the bentonite cut-off wall within the full facility area.

Till materials from the north drumlin would be placed in the area inboard of the containment dike to El. 110. However, because of the estimated surplus of clay material from the CA/THT project, the MDPW would provide this material for the bottom liner and capping systems. The MWRA would provide all remaining materials required for construction.

The second scenario would involve "full assistance" by the MDPW. Full assistance means the MDPW would construct the containment dike, slurry wall cut-off, and provide and place material inboard of the dike to El. 110 within the full facility area. In addition, the MDPW would provide clay for the bottom liner and capping systems and excess material for surcharging. Again, the MWRA would provide its own permanent pier facility, utilities and all other materials and equipment associated with constructing the actual landfill, as well as conducting the surcharging of fills placed below El. 110.

Construction schedules for both the "independent" and "full assistance" joint usage scenarios were evaluated and determined to be very similar from the standpoint of the MWRA. The resulting joint island usage schedule for the MWRA Phase I Cell is shown in Figure 15. In order for the MDPW to give "full assistance," some revised sequencing of its construction activities would be required.

7-03. COSTS FOR ALTERNATIVES

Cost estimates have been made for three development alternatives for comparison purposes. In addition, the cost of a fourth alternative (3b) has been included which assumes the MWRA only has to fund the development of the Phase I portion of the landfill to meet its schedule.

1. MWRA use of the island with no MDPW presence on the island.

2. Joint MWRA-MDPW usage with MDPW not available to participate in MWRA development activities ("independent" development).

3. Joint MWRA-MDPW usage with MDPW actively involved in constructing the MWRA landfill pad up to El. 110 ("full assistance").

    a. MDPW provides "full assistance" for Phase I through V

b. MDPW provides no assistance for Phase I but "full assistance" for Phase II through V.

Tables VII, VIII and IX provide itemized cost estimates for each alternative. Line item costs are provided for primary construction items identified as necessary for the development scenario. Where applicable, unit prices from the Black & Veatch RMFP were used. Also indicated are those items that might result in a "hardship" cost for the MDPW such as requiring increased haul time for fill placement and alterations in construction sequencing.

It is not considered feasible to estimate the magnitude of the hardship costs. While some components of the costs may be quantifiable, the majority of these costs are very subjective. There is no way of actually knowing the cost implications as they depend on factors existing at the time the work is undertaken. The existence of the hardship is noted to indicate that there is a potential that the indicated activity could be perceived to result in an increase cost and therefore result in the need for the MDPW to expend addition public monies.

Table X summarizes the present worth costs to the MWRA for this project and compares them to the cost estimate for the MCI-Cedar Junction site.

From Table X it is seen that total estimated present worth costs to the MWRA are as follows:

1. MWRA use of the island with no MDPW presence on the island: $47,976,000.

2. Joint MWRA-MDPW usage with MDPW not available to participate in MWRA development activities ("independent development") $73,993,000.

3. Joint MWRA-MDPW usage with MDPW actively involved in constructing the MWRA landfill to El. 110 ("full assistance"):

    a) MDPW provides "full assistance" for Phases I through V: $28,677,000.

    b) MDPW provides no assistance for Phase I but "full assistance" for Phases II through V: $62,206,000.

Bechtel/Parsons Brinkerhoff has had conversations with the U.S. Department of Transportation (DOT) regarding the DOT's criteria for cost reimbursement. The DOT has indicated that construction

to prepare the portion of Spectacle Island for MWRA use most likely would not be considered eligible for reimbursement from federal highway funds. If it is not, the MWRA would have to pay the costs for constructing all of the dikes around its landfill and placement of fill materials up to El. 110. The MDPW could still provide excavated soil for MWRA use in its landfill operation at "no cost.". If this were to occur, all joint usage scenarios would be essentially identical in cost to the MWRA at approximately $73,993,000.

VIII. INSTITUTIONAL ISSUES

8-01. INTRODUCTION

This section of the report addresses less tangible issues which may impact directly upon the feasibility of constructing a minor residuals landfill on Spectacle Island. Included are those issues that may have to be resolved in order to complete a project of the complexity of the joint MWRA-MDPW usage of Spectacle Island. These issues, however, are difficult to assess. They include such items as the probability of obtaining necessary permits in a timely manner, reconfiguration and delay in final island use and delays in MPDW construction at the island.

8-02. DISCUSSION

Spectacle Island is proposed to be used by the MDPW as a deposition site for excavated materials from the construction of the CA/THT. As part of that use, the refuse landfill existing on the island could be closed and the island restored to parkland a few years after the MDPW completed its work. With the MWRA minor residuals on the island, the use as a park will be delayed until after 2020. However, when the landfill is completed it can be used for recreational purposes. Were the MWRA landfill to remain open beyond the year 2020, which is possible should the landfill never be used for contingency measures, the opening of the park would be delayed accordingly.

The use of the island by the MDPW, the MWRA or both will require action or approval by the City of Boston, the MDEM and possibly the state legislature. Extended delays in returning the island to parkland use could require a two-third majority vote of the Massachusetts House and Senate.

The final use of the island as a park is also the primary basis upon which it appears that permits would be granted to the MDPW to construct dikes and fill the water of Boston Harbor. A Section 404 permit to fill the water of Boston Harbor will be needed from the Corps of Engineers (COE). To obtain this permit it must be demonstrated, among other things, that the work has no practical alternative, that it is being done for the public good and that it is the "least damaging" of the practicable alternatives. Conversations with representatives of the COE have indicated a willingness to discuss the permit process for the joint usage of the island and elaborate on what they would require be demonstrated to obtain a permit to fill for joint

usage. Initial indicators are that it will be more difficult to obtain a permit to fill Boston Harbor for the joint usage of the island.

Filling of Boston Harbor will also require approvals under MGL Chapter 91 and reviews by the Massachusetts Office of Coastal Zone Management. To comply with MGL Chapter 91 it will be necessary to demonstrate that the filling is for a water dependent use. Creation of an island park appears to satisfy this requirement. Joint usage for the creation of a residuals landfill disposal site is less clear. However, ultimately, the island would become a park. It is possible, if the joint usage can not be permitted, to obtain an exemption from the regulation by vote of the Massachusetts governing bodies.

Joint usage of the island within the confines established by the dikes proposed by the MDPW, by necessity, significantly alters the architectural contours proposed by the MDPW for use as a park. The proposed joint final grading plan eliminates the distinct north and south hills that historically have existed on the island. While some flexibility does exist in the final configuration of the island, maintaining the "spectacle" appearance that is stated as desirable by the MDPW for use as a park most likely will not be possible.

Both agencies have on-going study processes that will be delayed by choosing to pursue the joint use of the island. Use of the island by the MWRA will require joint agency permitting and the need to conduct supplemental studies. These studies would need to be completed within the courted order scheduling. It is doubtful that the required studies could be done while maintaining the court ordered schedule.

The MDPW has assumed that closure of the existing landfill on Spectacle island can be done at the time the materials placed on the island from the CA/THT project are closed. At that time, the MDPW will have sufficient materials to efficiently and cost effectively close the island. However, the DEQE in the past has required that development projects such as this provide an interim closure program. This would require that the landfill be regraded and covered with low permeability soil and possibly temporary leachate collection prior to any fill being placed on the island. If this is required, it could have a significant impact on the construction schedule and project costs.

Delays in the CA/THT construction schedule for whatever reasons could affect the timely development of the MWRA landfill. The MWRA would at worst be required to operate under the joint usage, independent development scenario described previously.

This would require that the MWRA prepare a design and contract for these services in a short period of time. The actual time available would be dependent on how predictable was the cause of the MDPW delay. The MWRA would have to accept the additional costs associated therewith, but the Phase I cell could probably be operational by 1995.

Delays in construction on the island due to weather, delays due to permitting and from labor disputes are contingencies over which the MWRA would manifest very little control. Permitting delays might be brought on by litigation which could last for years. Labor disputes would most likely be of a shorter duration, but could, nevertheless, jeopardize timely completion of the Phase I cell. The unpredictability of these two contingencies, however, would be the same for any site. Thus, it is considered that these contingencies are equally problematic for MCI-Cedar Junction or the Rowe Quarry or Spectacle Island.

Coordinating the efforts of two major earthwork contractors on an island is difficult at best. Both contractors will need to be functioning at peak output at the same time. Allocation of space on the island for staging, personnel support, access, construction traffic and other peripheral reasons will be necessary. The proposed conceptual design for joint usage of the island minimizes contractor interference. However it will still be necessary for each contractor to traffic through the other's work area and rely on the other's provision of material and work effort to complete their contracts.

Joint usage will also require close joint agency interaction. Design and construction efforts by both parties will have to be coordinated. One agency will need to accept the responsibility for that coordination. It is understood that designing and contracting the joint use as one project has been dismissed as infeasible.

IX. CONCLUSIONS ON JOINT ISLAND USAGE

Information on conditions existing at Spectacle Island has been assembled and reviewed. Conditions have also been observed during a site visit. MDPW planning documents have been reviewed and discussed at meetings held with the MDPW and its management consultants. MWRA planning documents, likewise, have been reviewed and discussed with members of the MWRA and its RMFP consultants.

Design criteria have been assembled and the feasibility of developing Spectacle Island independently and jointly with the MDPW has been evaluated. Conceptual plans have been developed for both alternatives and compared to project criteria. Costs have been estimated for the work in a manner similar to that used on previous studies by the RMFP consultant.

It appears that it is technically feasible to construct a minor residuals landfill on Spectacle Island without the MDPW being present on the island. However, this alternative does not warrant further consideration because of its high cost and the fact that the MDPW is committed to using the island for the CA/THT project.

For the joint usage scenario, it appears that the landfill can be configured within the final grading plan to place 16.7 million cubic yards of material on the island in a way that results in a workable operation for both agencies. On a strictly technical basis, the landfill site can be prepared and would perform satisfactorily. Sufficient time exists for the landfill to be constructed and have a Phase I cell available to meet the 31 August 1995 deadline.

Various assumptions are possible as to each agency's needs and willingness to assist the other with the construction process. If it is assumed that the MDPW will not or cannot incur the costs to prepare the site for MWRA use, the total present worth costs for the MWRA to construct the site are more than three times the costs for the currently identified MCI-Cedar Junction site (Case 2, Table X). If it is assumed the MDPW will or can incur the costs to prepare the full site for MWRA use, the present worth costs for the MWRA to construct the landfill are slightly greater than for MCI-Cedar Junction (Case 3a, Table X).

The development option nearest in cost to MCI-Cedar Junction requires the following major assumptions:

1. The MDPW will alter its work plans sufficiently enough to construct the containment dike and place fill to provide a

working level that MWRA can use to construct its landfill by 1995.

2. Permits can be obtained to create the newly filled land for a landfill in a timely manner.

3. The MDPW will share fill materials with the MWRA.

4. The U.S. DOT will fund the site preparation for the portion of the project area used by the MWRA as a landfill.

5. The various agencies committed to the use of the island as a park will accept a less attractive configuration and a significant delay (20 plus years) in the availability of the entire island for park use.

6. The MDPW CA/THT project will be on schedule such that fill materials will be available to meet MWRA time requirements.

7. The hardship costs identified for the MDPW associated with altering its plans are not significant and are acceptable to the MDPW.

8. Deviations from the present intermediate, court-ordered milestone dates are possible.

9. Approvals to use the island from the City of Boston, the DEM and possibly the state legislature can be obtained in a timely manner.

It is unlikely that all of the above conditions will be met on a project of this complexity.

If permits can be obtained for the joint use of the island, the most optimistic cost estimated is 20 percent greater than the costs identified for MCI-Cedar Junction. The most probable costs approach three times the costs identified for MCI-Cedar Junction.

The proposed construction of a minor residuals landfill on Spectacle Island as part of a joint usage with the MDPW is technically feasible. The need for approvals from the City of Boston, DEM and state legislature; the requirement to maintain the island as parkland for funding of MDPW activities on the island; delays in court order schedules and the probable development costs result in the site usage being an infeasible alternative to MCI-Cedar Junction.

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TABLE I
ESTIMATED QUANTITIES AND
PROBABLE DISPOSAL SITES
CA/THT CONSTRUCTION ACTIVITIES

DISPOSAL SITE	MATERIAL/CLASSIFICATION	QUANTITY (CU. YD.)	TOTAL (CU. YD.)
SPECTACLE ISLAND	EXCAVATED SOIL/CAT. I&II	7,902,000	
	EXCAVATED SOIL/CAT. III	3,803,000	
	EXCAVATED ROCK	337,000	
	DREDGED SEDIMENTS/CAT. III	85,000	12,127,000
FADS	DREDGED SEDIMENTS/CAT. I&II	1,205,000	
	DREDGED ROCK	201,000	1,406,000
			13,533,000

NOTE: VOLUMES ARE IN PLACE PRIOR TO EXCAVATION AND DREDGING.

FILE NO

TABLE II

DAILY MDPW DELIVERIES TO SPECTACLE ISLAND

YEAR	NO. OF BARGES	APPROXIMATE VOLUME (CU. YD.)
1-2	9	11,700
2-3	12	15,600
4	<7	<9,100
4-8	<2	<2,600
9	1/week	1,300/Week

DELIVERY STARTS AT END OF YEAR 1 (1991)

TABLE III

REQUIRED CONSTRUCTION EQUIPMENT FOR
MDPW DEVELOPMENT ON SPECTACLE ISLAND

MAJOR EQUIPMENT	QUANTITY
BARGE LOADING RAMPS	1
PORTAL CRANES (TO LOAD BARGES)	4
LINK SPANS (TO LOAD BARGES)	5
DECK BARGES (1300 CYD CAPACITY)	23
DUMP SCOWS	-
TUGS (500 HP)	3
TUGS (1000 HP)	4
TUGS (OCEAN GOING)	-
LOADERS (6 CYD CAP.)	20
ART. DUMP TRUCKS (12-15 CYD CAP.)	30
TRACK MOUNTED DOZERS	5
GRADERS	1
FERRY BOAT FOR WORKERS	1
PERSONNEL	100

NOTES: (1) EQUIPMENT LISTED REPRESENT MINIMUM REQUIREMENTS. THE ACTUAL AMOUNT WOULD BE LARGER DEPENDING ON AVAILABILITY.

TABLE IV

MDPW PERMITS FOR SPECTACLE ISLAND

PERMIT TYPE	REGULATING AGENCY
ENF/EIR	MEPA UNIT OF EOEA
WETLAND PROTECTION ACT (ORDER OF CONDITIONS)	BOSTON CONSERVATION COMMISSION AND DEQE
WATER QUALITY CERTIFCATE	DEQE (WPC)
WATERWAY CHAPTER 91	DEQE
MASS. COASTAL ZONE MANAGEMENT	CZM
RIVER AND HARBOR ACT (SECTION 10 FINDING)	COE
CLEAN WATER ACT	COE

TABLE V

MWRA REQUIRED LANDFILL VOLUMES

MATERIALS	TOTAL QUANTITY (CU.YD.)	PHASE I QUANTITY (CU.YD.)
GRIT AND SCREENINGS	700,800	140,000
CONTINGENCY CAPACITY	1,699,200	310,000
PRE-COMPACTION TOTAL	2,400,000	450,000
POST-COMPACTION TOTAL (1)	1,920,000	360,000
DAILY COVER (2)	320,000	60,000
INTERMEDIATE/FINAL COVER (2)	320,000	60,000
BERM AND DOUBLE LINER (2)	640,000	120,000
TOTAL LANDFILL VOLUME	3,200,000	600,000

NOTES:

1. Assumes compaction after placement.

2. Assumes 40 percent of landfill capacity will be consumed by the berm and double liner systems and the daily, intermediate and final covers.

TABLE VI

MWRA PERMITS FOR SPECTACLE ISLAND

PERMIT TYPE	REGULATING AGENCY
OBLIGATORY PERMITS	
ENF/EIR	MEPA UNIT OF EOEA
LANDFILL SITING/DESIGN/ CLOSURE OPERATION	DEQE (WPC)
CONTINGENT PERMITS	
WETLAND PROTECTION ACT (ORDER OF CONDITIONS)	BOSTON CONSERVATION COMMISSION AND DEQE
WATER QUALITY CERTIFICATE	DEQE (WPC)
WATERWAYS CHAPTER 91 (SEE NOTE 1)	DEQE
MASS. COASTAL ZONE MGMT.	CZM
RIVER AND HARBOR ACT (SECTION 10 FINDING)	COE
CLEAN WATER ACT	COE

NOTES:

1. DEPENDENT UPON BOSTON CONSERVATION COMMISSION ORDER OF CONDITIONS.

FILE NO. 10264-00 HALEY & ALDRICH, INC.

TABLE VII

MWRA INDEPENDENT USAGE COSTS

ITEM NO.	DESCRIPTION	QUANTITY PHASE I	QUANTITY PHASE II-V	UNITS	UNIT PRICE	CONSTRUCTION TIME (MONTHS) PHASE I	MWRA TOTAL ITEM COST PHASE I	MWRA TOTAL ITEM COST PHASE II-V
1	SITE CLEARANCE	70	NA	ACRE	$5,915	2	$414,000	---
1A	MOBILIZATION	1	NA	LS	$2,300,000	6	$2,300,000	---
2	PERMANENT PIER FACILITY	1	NA	LS	$1,162,000	8	$1,162,000	---
2A	DREDGING	37,000	NA	CY	$14	1	$518,000	---
3	UTILITY CORRIDOR	6,000	NA	LF	$274	6	$1,644,000	---
4	SUPPORT FACILITIES	---	---	LS	---	2	$2,071,000	$1,842,000
5	CLOSE REFUSE LANDFILL	38	NA	ACRE	$417,220	17	$15,858,000	---
6	CONSTRUCT BOTTOM DOUBLE LINER	7	25	ACRE	$248,125	4	$1,737,000	$6,203,000
6A	LEACHATE/GAS COLLECTION AND STORAGE SYSTEM	1	4	LS	$118,375	---	$118,375	$473,500
7	ROADS	4,170	5,560	SY	$22/$15	4	$92,000	$83,000
8	MISCELLANEOUS CAPITAL COSTS (SURFACE WATER CONTROL, SLOPE EROSION CONTROL & LANDSCAPING)	7	25	ACRE	$13,225	NA	$ 92,575	$330,625
	SUBTOTAL:						$26,006,950	$8,932,125
	CONTINGENCY @ 20%						$5,201,390	$1,786,425
	SUBTOTAL PLUS CONTINGENCY:						$31,208,340	$10,718,550
	ENGINEERING SERVICES @ 15%						4,681,250	1,607,780
	LEGAL AND ADMINISTRATIVE @ 2%						624,170	214,370
	INTEREST @ 8.63%						2,691,720	924,470
	TOTAL CAPITAL COSTS:						$39,205,480	$13,465,170
	TOTAL OPERATION AND MAINTENANCE			YR	$666,000			

NOTES: 1. THIS TABLE APPLIES TO DEVELOPMENT COSTS WHEREIN THE MDPW DOES NOT USE SPECTACLE ISLAND.

2. SEE FIGURES 6 THROUGH 10 FOR DETAILS.

3. ALL COSTS IN 1989 DOLLARS AND ARE FOR CASE 1, TABLE I.

FILE NO. 10264-00 HALEY & ALDRICH, INC.

TABLE VIII
MWRA JOINT USAGE
INDEPENDENT DEVELOPMENT COSTS

ITEM NO.	DESCRIPTION	QUANTITY PHASE I	QUANTITY PHASE II-V	UNITS	UNIT PRICE	CONSTRUCTION TIME (MONTHS) PHASE I	TOTAL COST MWRA PHASE I	TOTAL COST MWRA PHASE II-V	HARDSHIP COST MDPW PHASE I	HARDSHIP COST MDPW PHASE II-V
1	MOBILIZATION	1	NA	LS	$2,800,000	6	$2,800,000	$0	NO	NO
2	PERMANENT PIER FACILITY	1	NA	LS	$1,162,000	8	$1,162,000	$0	YES	NO
3A	DREDGING	52,000	NA	CY	$14	1	$728,000	$0	NO	NO
3	UTILITY CORRIDOR	6,000	NA	LF	$274	6	$1,644,000	$0	NO	NO
4	SUPPORT FACILITIES	-	-	LS	-	2	$2,071,000	$1,842,000	NO	NO
5	DREDGE/CONSTRUCT DIKE	2,200	2,900	LF	$9,132	13	$20,090,400	$26,482,800	NO	NO
6	EXCAVATE & PLACE TILL MATERIAL BELOW EL. 110	325,000	487,500	CY	$5	13	$1,625,000	$2,437,500	NO	NO
7	STABILIZE FOUNDATION SOILS	96,500	128,800	CY	$3	13	$289,800	$386,400	NO	NO
8	CONSTRUCT CUT-OFF WALLL	1,400	2,000	LF	$800	2	$1,120,000	$1,600,000	YES	YES
9	CONSTRUCT BOTTOM DOUBLE LINER	12	48	ACRE	$248,125	8	$2,977,500	$11,910,000	NO	NO
9A	LEACHATE/GAS COLLECTION AND STORAGE SYSTEMS	1	4	LS	$118,375	-	$118,375	$473,500	NO	NO
10	STABILIZE EXISTING REFUSE	NA	210,000	CY	$3	NA	$0	$630,000	NO	YES
11	ROADS	5,120	4,880	SY	$15	NA	$76,800	$73,200	NO	NO
12	MISC. CAPITAL COSTS	12	48	ACRE	$12,683	NA	$152,196	$608,784	NO	NO
	SUBTOTAL						$34,855,071	$46,444,184		
	CONTINGENCY @ 20%						$6,971,014	$9,288,837		
	SUBTOTAL WITH CONTINGENCY						$41,826,085	$55,733,021		
	ENGINEERING SERVICES @ 15%						$6,273,913	$8,359,953		
	LEGAL & ADMIN. @ 2%						$836,522	$1,114,660		
	INTEREST DURING CONST. @ 8.62%						$3,613,774	$4,815,333		
	TOTAL CAPITAL COST						$52,550,293	$70,022,967		
	TOTAL OPERATION & MAINTENANCE			YR	$676,320					

NOTES: 1. THIS TABLE APPLIES TODEVELOPMENT COSTS WHEREIN:
a) MWRA PREPARES THE PAD FOR THE FULL LANDFILL AREA.
b) MDPW PROVIDES CLAY FOR THE BOTTOM LINER AND CAPPING SYSTEMS.

2. SEE FIGURES 11 THROUGH 15 FOR DETAILS.

3. ALL COSTS IN 1989 DOLLARS AND ARE FOR CASE 2, TABLE I.

FILE NO. 1[illegible]-[illegible] HALEY & ALDRICH, INC.

TABLE II
MWRA JOINT USAGE
FULL MDPW ASSISTANCE COSTS

ITEM NO.	DESCRIPTION	QUANTITY PHASE I	QUANTITY PHASE II-V	UNITS	UNIT PRICE	CONSTRUCTION TIME (MONTHS) PHASE I	TOTAL COST MWRA PHASE I	TOTAL COST MWRA PHASE II-V	HARDSHIP COST MDPW PHASE I	HARDSHIP COST MDPW PHASE II-V
1	MOBILIZATION	1	NA	LS	$2,800,000	6	$2,800,000	$0	NO	NO
2	PERMANENT PIER FACILITY	1	NA	LS	$1,162,000	8	$1,162,000	$0	YES	NO
2A	DREDGING	52,000	NA	CY	$14	1	$728,000	$0	NO	NO
3	UTILITY CORRIDOR	6,000	NA	LF	$274	6	$1,644,000	$0	NO	NO
4	SUPPORT FACILITIES	-	-	LS	-	2	$2,071,000	$1,842,000	NO	NO
5	DREDGE/CONSTRUCT DIKE	2,200	2,900	LF	$0	13	$0	$0	YES	YES
6	PLACE FILL MATERIAL BELOW EL. 110	325,000	487,500	CY	$0	13	$0	$0	YES	YES
7	STABILIZE FOUNDATION	96,600	128,800	CY	$3	13	$289,800	$386,400	NO	NO
8	CONSTRUCT CUT-OFF WALL	1,400	2,000	LF	$0	2	$0	$0	YES	YES
9	CONSTRUCT BOTTOM DOUBLE LINER	12	48	ACRE	$201,900	8	$2,422,800	$9,691,200	YES	YES
9A	LEACHATE/GAS COLLECTION AND STORAGE SYSTEMS	1	4	LS	$118,375	-	$118,375	$473,500	NO	NO
10	STABILIZE EXISTING REFUSE	NA	210,000	CY	$3	NA	$0	$630,000	NO	YES
11	ROADS	1,220	4,880	SY	$15	NA	$18,300	$73,200	NO	NO
12	MISC. CAPITAL COSTS	12	48	ACRE	$12,683	NA	$152,196	$608,784	NO	NO
	SUBTOTAL						$11,406,471	$13,705,084		
	CONTINGENCY @ 20%						$2,281,294	$2,741,017		
	SUBTOTAL WITH CONTINGENCY						$13,687,765	$16,446,101		
	ENGINEERING SERVICES @ 15%						$2,053,165	$2,466,915		
	LEGAL & ADMIN. @ 2%						$273,755	$328,922		
	INTEREST DURING CONST. @ 8.6%						$1,182,623	$1,420,943		
	TOTAL CAPITAL COSTS						$17,197,308	$20,662,881		
	TOTAL OPERATION & MAINTENANCE			YR	$652,820					

NOTES: 1. THIS TABLES APPLIES TO DEVELOPMENT COSTS WHEREIN:
a) MDPW PREPARES THE PAD FOR THE FULL LANDFILL AREA.
b) MDPW PROVIDES CLAY FOR THE BOTTOM LINER AND CAPPING SYSTEMS.

2. SEE FIGURES 11 THROUGH 15 FOR DETAILS.

3. ALL COSTS ARE IN 1989 DOLLARS AND ARE FOR CASE 3a, TABLE I.

FILE NO. 10264-09 HALEY & ALDRICH, INC.

TABLE X

LANDFILL COST COMPARISON

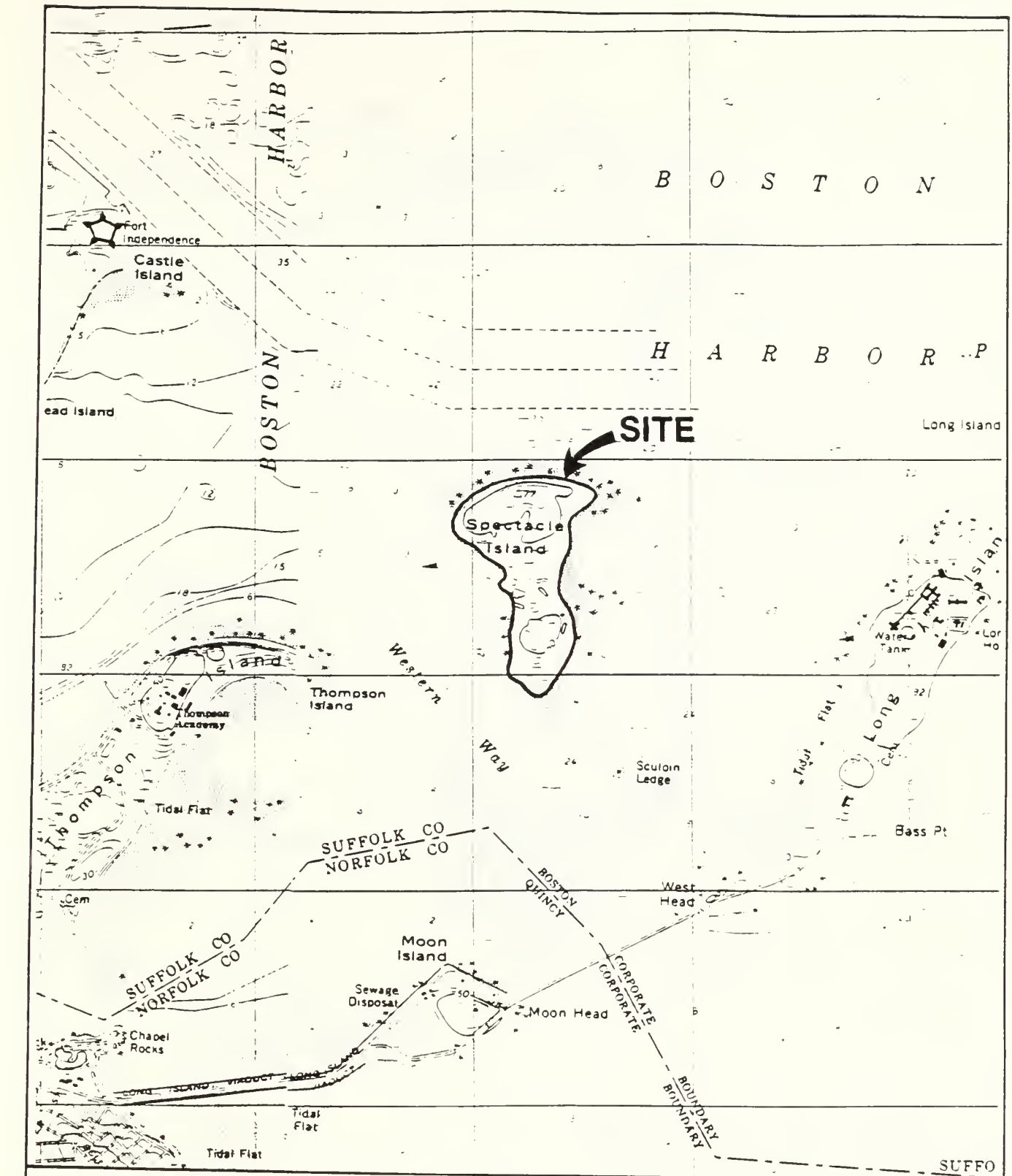
SITE/CONDITION	TOTAL PRESENT WORTH CAPITAL COST	O & M COST (YR)	TOTAL PRESENT WORTH COST
MCI-CEDAR JUNCTION	$17,903,000	$497,000	$23,800,000
SPECTACLE ISLAND			
1. IND. USAGE/IND. DEV. (PHASE I-V)	$40,277,000	$666,000	$47,976,000
2. JOINT USAGE/IND. DEV. (PHASE I-V)	$66,176,000	$676,000	$73,993,000
3a. JOINT USAGE/FULL ASSIST. (PHASE I-V)	$21,131,000	$653,000	$28,677,000
3b. JOINT USAGE/IND.DEV. (PHASE I) FULL ASSIST. (PHASE II-V)	$54,660,000	$653,000	$62,206,000

NOTES: 1. FOR BASIS OF COST ESTIMATES IN 1989 DOLLARS SEE:

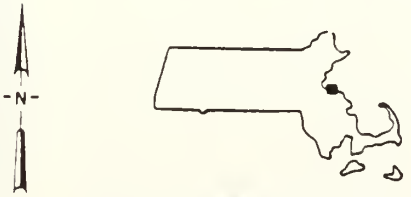
SPECTACLE ISLAND CASE	TABLE
1	VII
2	VIII
3a	IX

COSTS FOR 3b ADAPED FROM DETAILS IN TABLES VIII AND IX.

2. MCI-CEDAR JUNCTION COSTS FROM RMFP INFORMATION.



SITE COORDINATES: 42°19'27"N 70°59'14"W



U.S.G.S. QUADRANGLE: HULL, MA

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

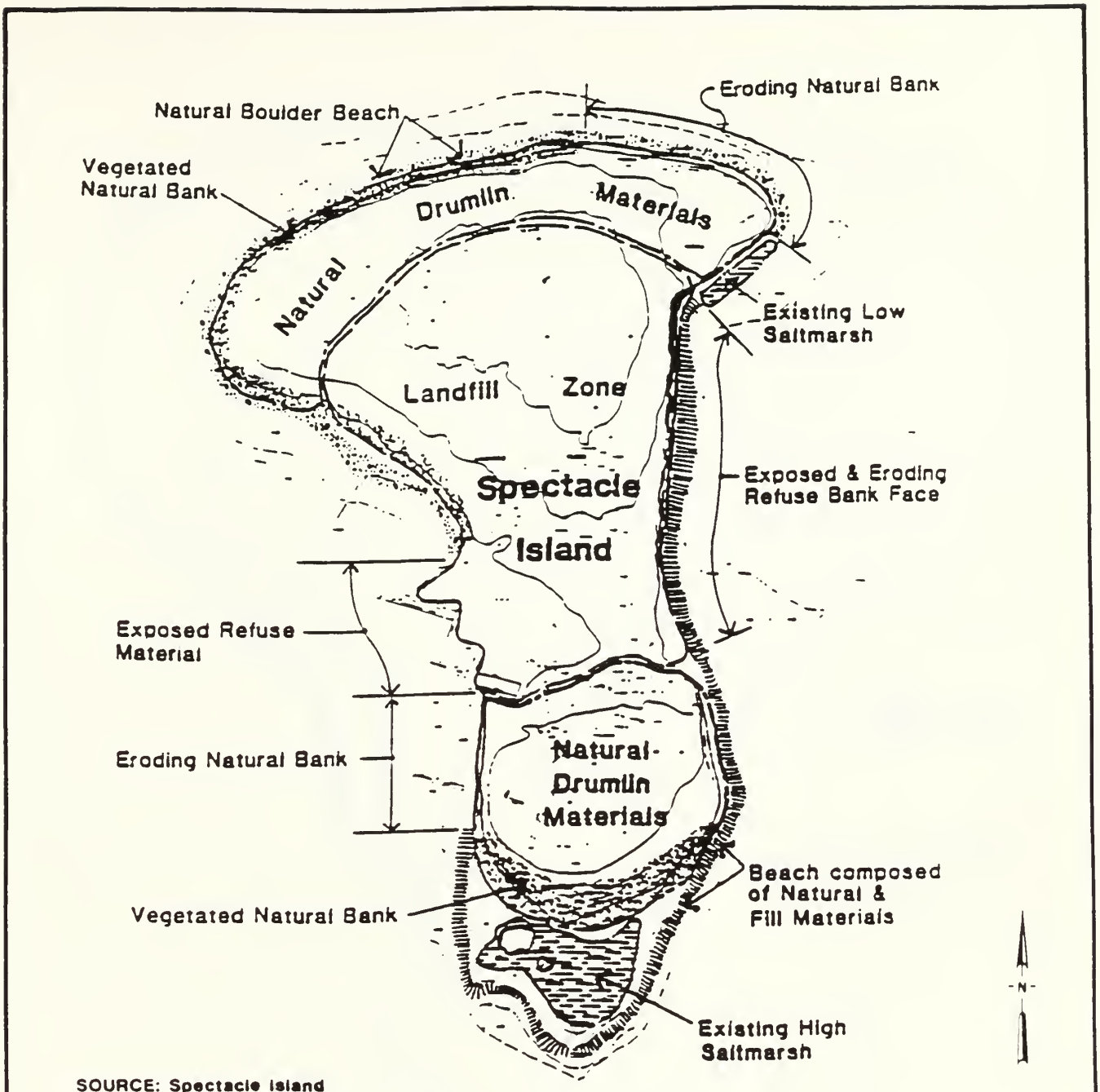
PROJECT LOCUS

APPROX. SCALE 1:25,000

APRIL 1989

FILE NO. 10264-00 A1

FIGURE 1



SOURCE: Spectacle Island
Engineering Feasibility Study
Final Report - August 1984
BSC Engineering

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

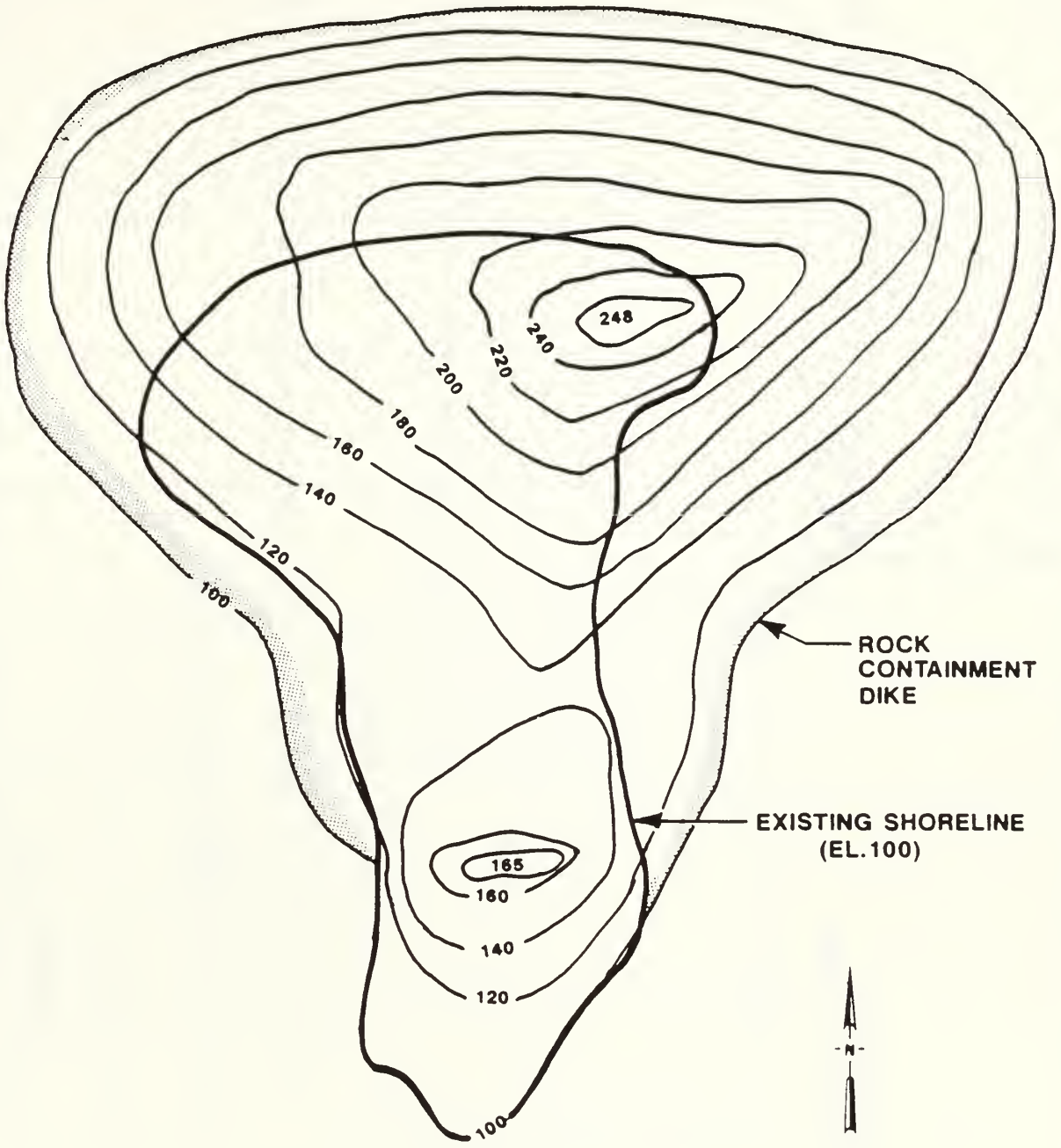
SPECTACLE ISLAND
PRESENT PHYSICAL CONDITIONS

SCALE: AS SHOWN

JULY 1989

FILE NO.10264-00

FIGURE 2



FILE NO.10264-00

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

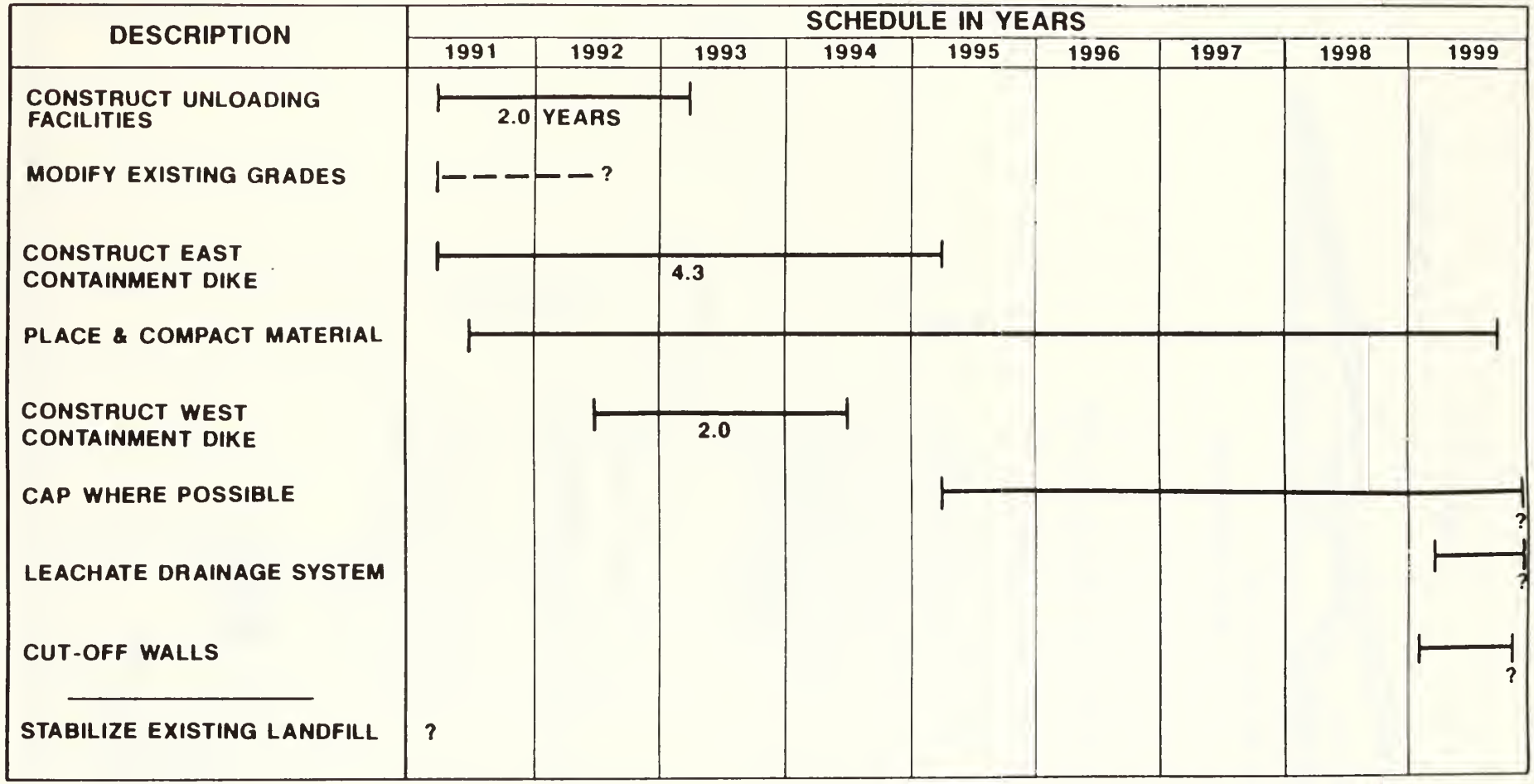
MDPW FINAL SPECTACLE ISLAND CONFIGURATION

SCALE: AS SHOWN

JULY 1989

FIGURE 3

FILE NO. 10264-00



NOTE:

QUESTION MARKS INDICATE LENGTH OF TIME UNKNOWN TO HALEY & ALDRICH, INC.

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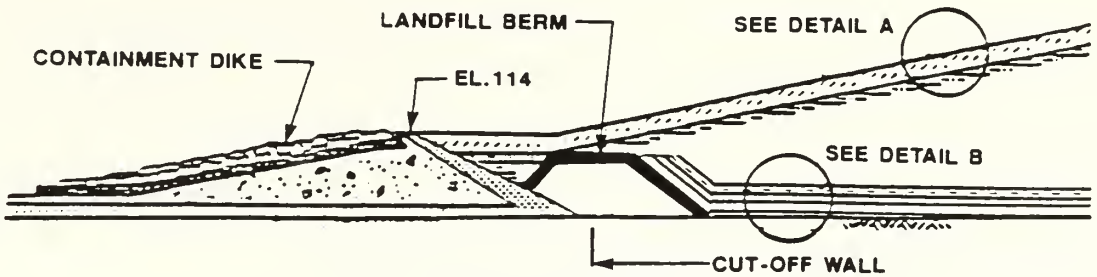
FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

MDPW ACTIVITIES SCHEDULE

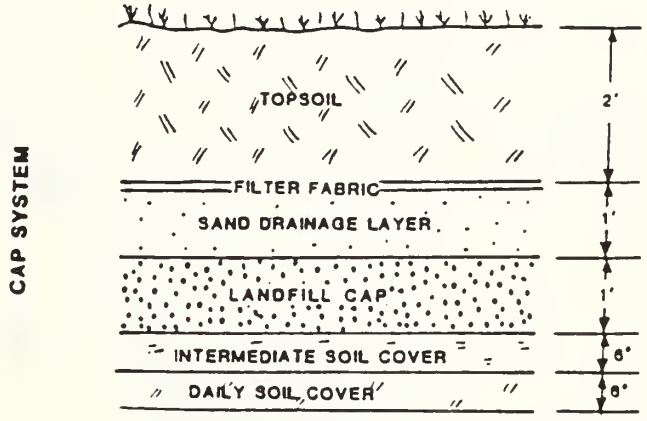
SCALE: AS SHOWN

JULY 1989

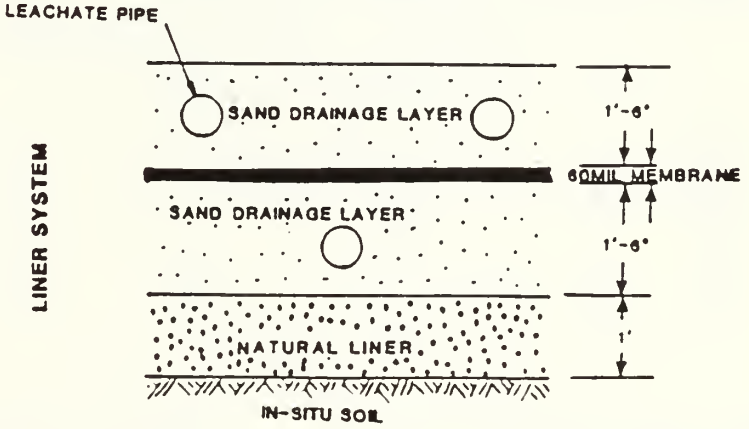
FIGURE 4



ELEVATION VIEW



DETAIL A



DETAIL B

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

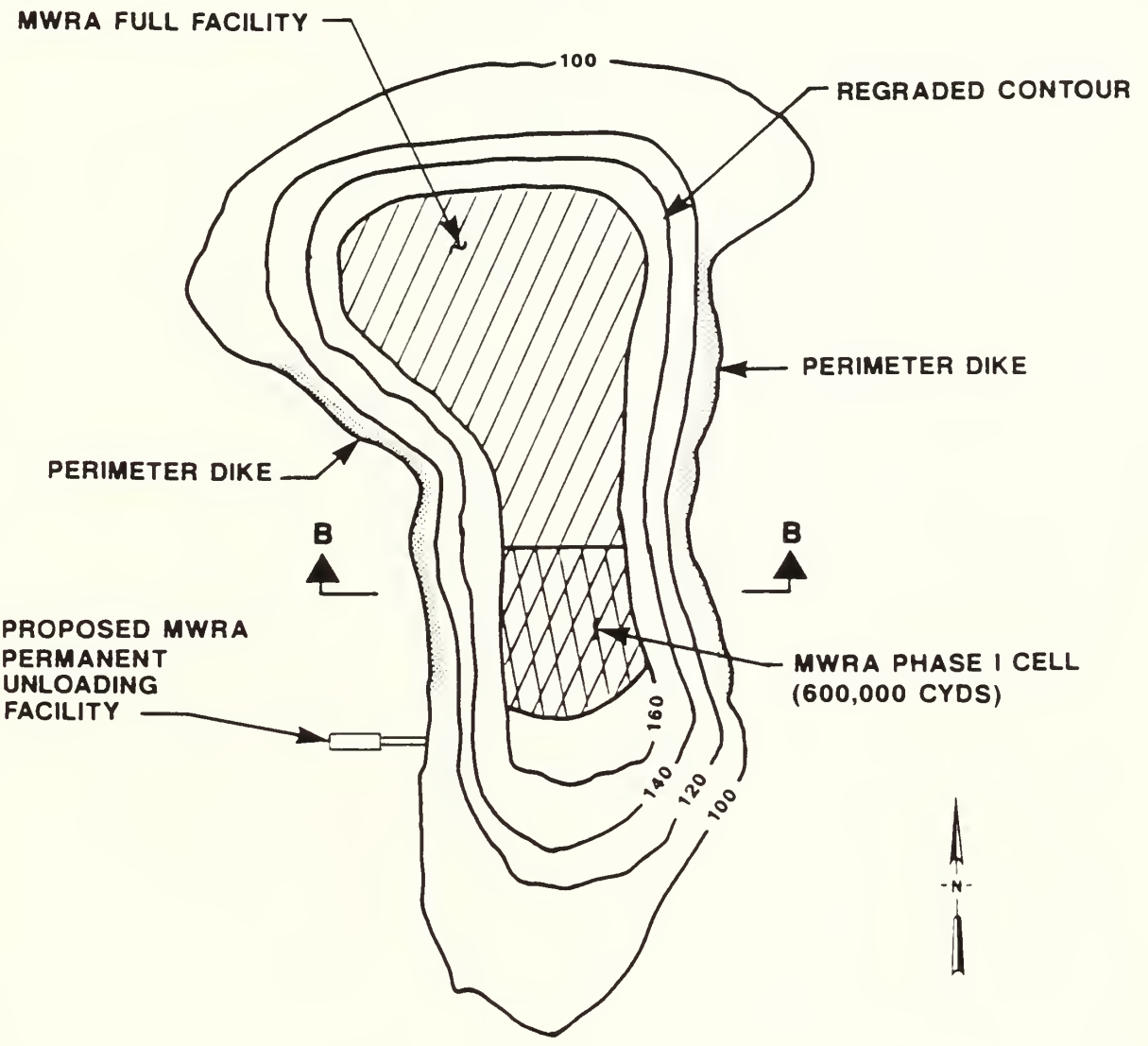
TYPICAL BOTTOM DOUBLE LINER AND CAPPING SYSTEMS

SCALE: AS SHOWN

JULY 1989

FILE NO. 10264-00

FIGURE 5



NOTE: SEE SECTION B-B, FIGURE 9

400 0 400 800
SCALE FEET

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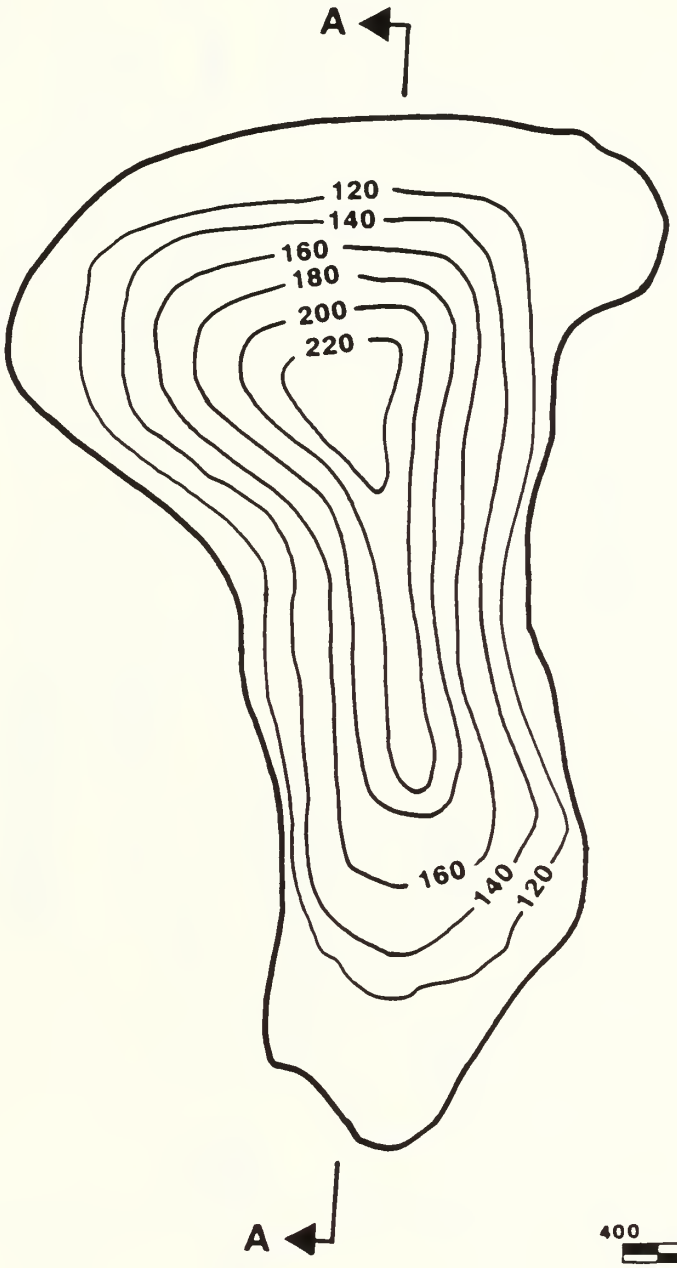
FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

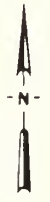
MWRA INDEPENDENT USAGE -
LANDFILL AND PHASE I CELL LOCATION

SCALE: AS SHOWN JULY 1989

FILE NO.10264-00

FIGURE 6





400 0 400 800

SCALE FEET

NOTE: SEE SECTION A-A, FIGURE 8

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

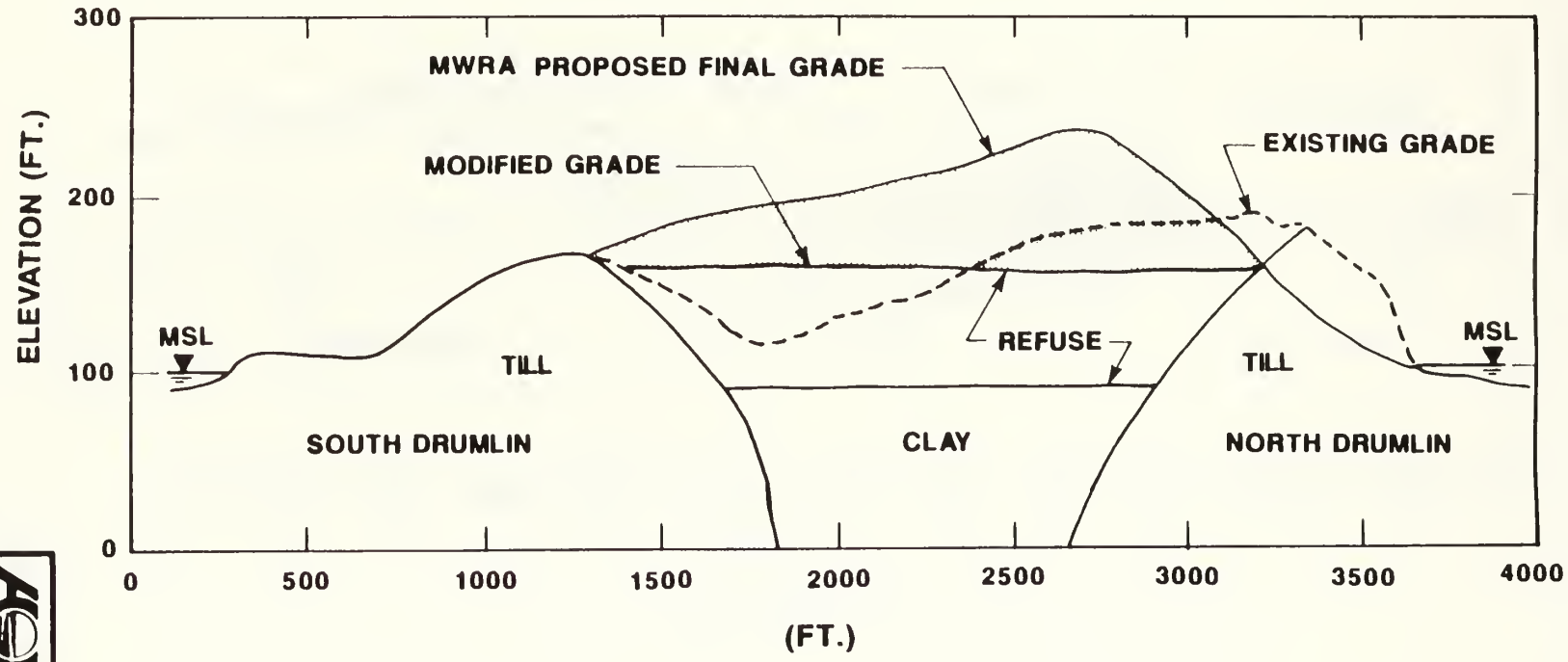
MWRA INDEPENDENT USAGE -
PROPOSED FINAL GRADES

SCALE: AS SHOWN JULY 1989

FILE NO. 10264-00

FIGURE 7

FILE NO.10264-00



SECTION A - A

NOTE: SEE SECTION LINE, FIGURE 7

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MWRA INDEPENDENT USAGE -
NORTH-SOUTH SECTION

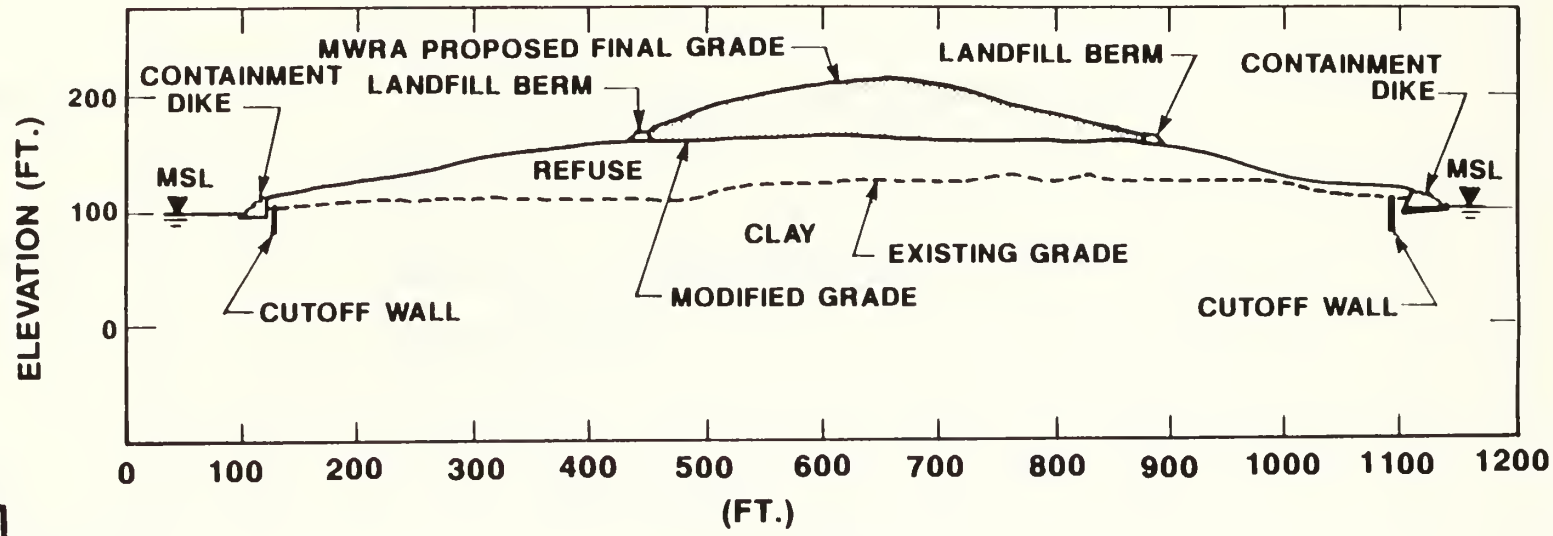
FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

SCALE: AS SHOWN

JULY 1989

FIGURE 8

FILE NO.10264-00



SECTION B - B

NOTE: SEE SECTION LINE, FIGURE 6

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

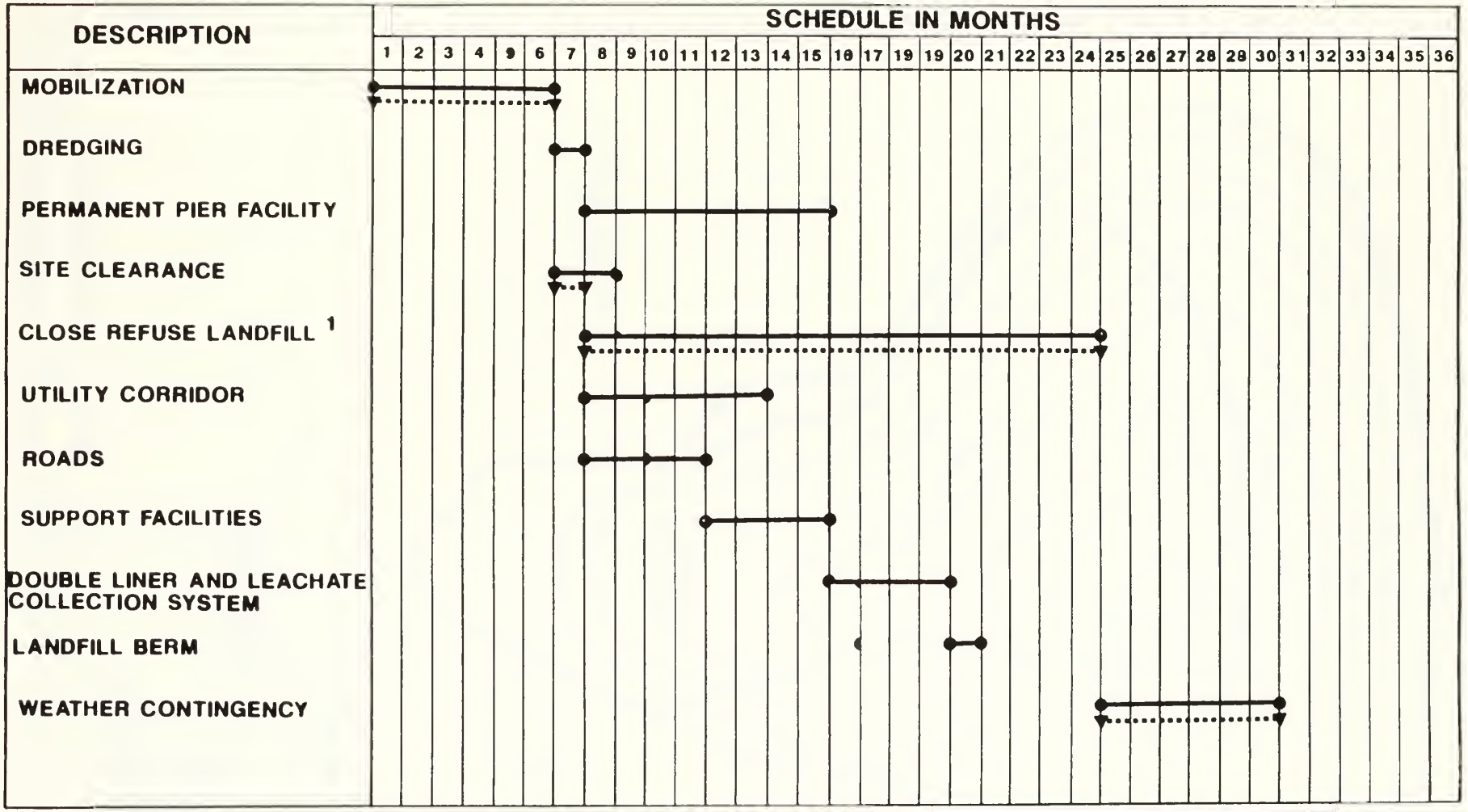
MWRA INDEPENDENT USAGE -
EAST-WEST SECTION

SCALE: AS SHOWN

JULY 1988

FIGURE 9

FILE NO.10264-00



CRITICAL PATH ▼·····▼

NOTE:

1. CONSTRUCTION TIME ASSUMES THE EXISTING LANDFILL WILL BE COMPLETELY CLOSED DURING PHASE I OPERATION.

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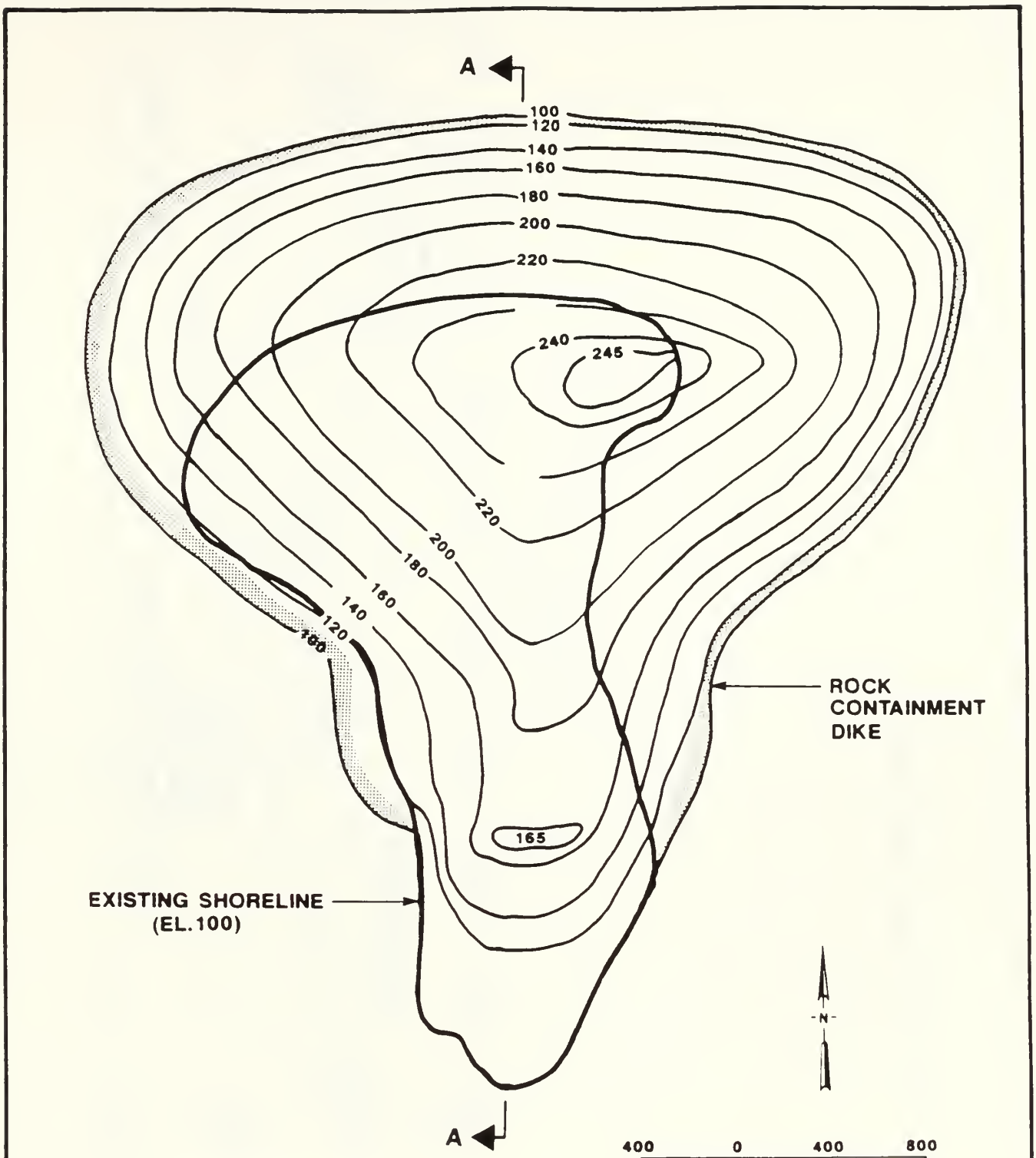
FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

MWRA INDEPENDENT USAGE - PHASE I CELL SCHEDULE

SCALE: AS SHOWN

JULY 1989

FIGURE 10



NOTE: SEE SECTION A - A, FIGURE 12

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

**MWRA JOINT USAGE -
PROPOSED FINAL GRADE
(16.7 MILLION CU. YDS.)**

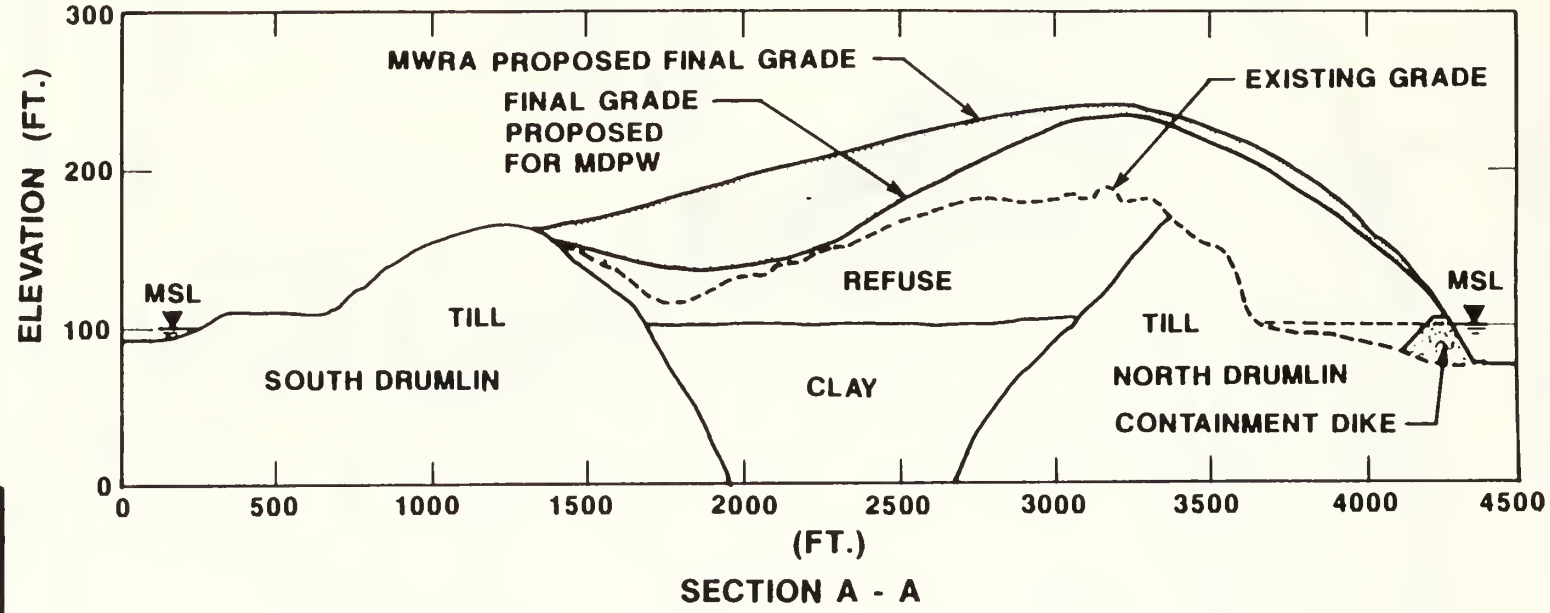
SCALE: AS SHOWN

JULY 1989

FILE NO.10264-00

FIGURE 11

FILE NO.10264-00



SECTION A - A

NOTE: SEE SECTION LINE, FIGURE 11

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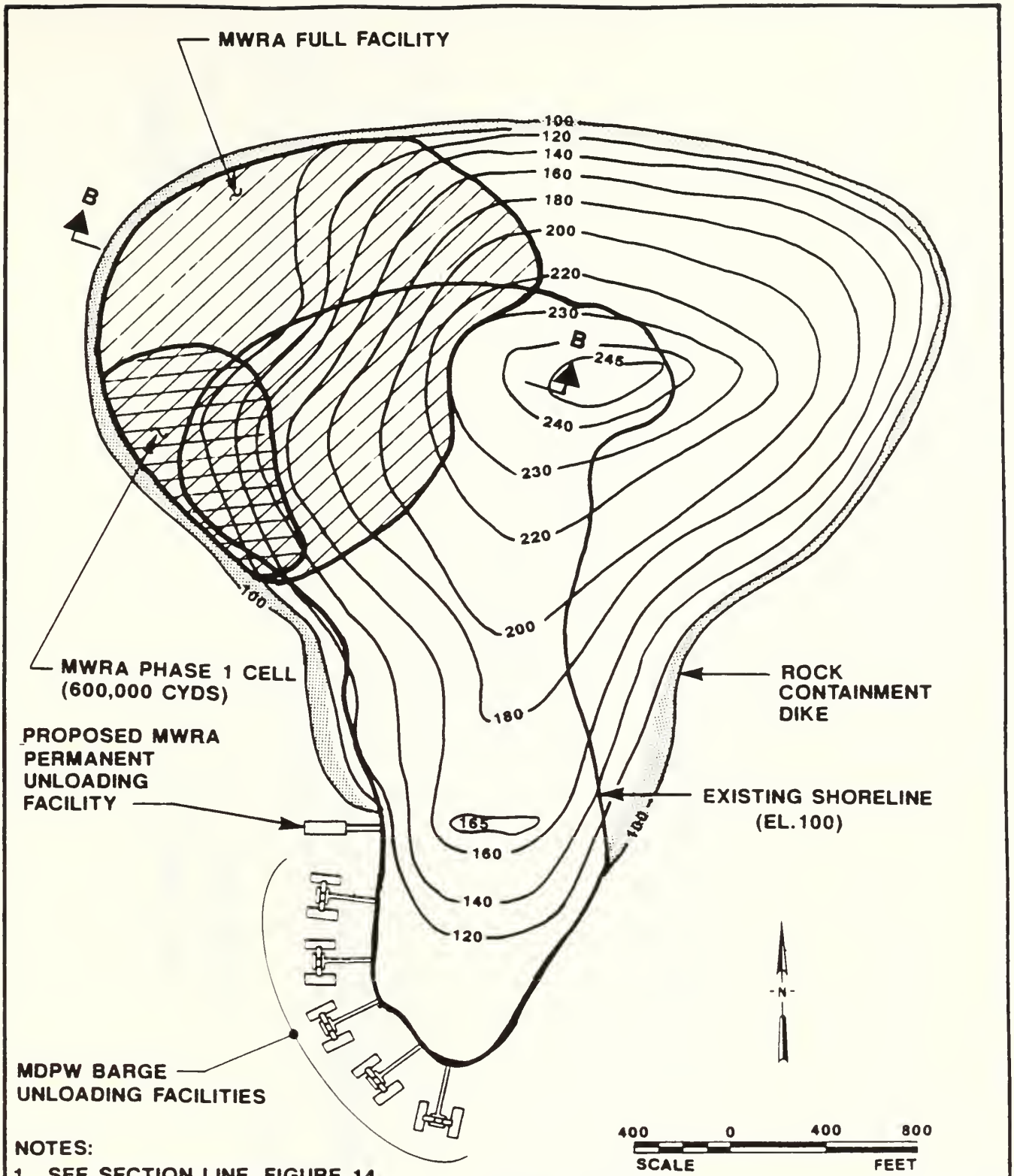
FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

MWRA JOINT USAGE -
NORTH-SOUTH SECTION

SCALE: AS SHOWN

JULY 1989

FIGURE 12



NOTES:

1. SEE SECTION LINE, FIGURE 14
2. CONTOURS SHOWN ARE THOSE CONSTRUCTED BY MDPW

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

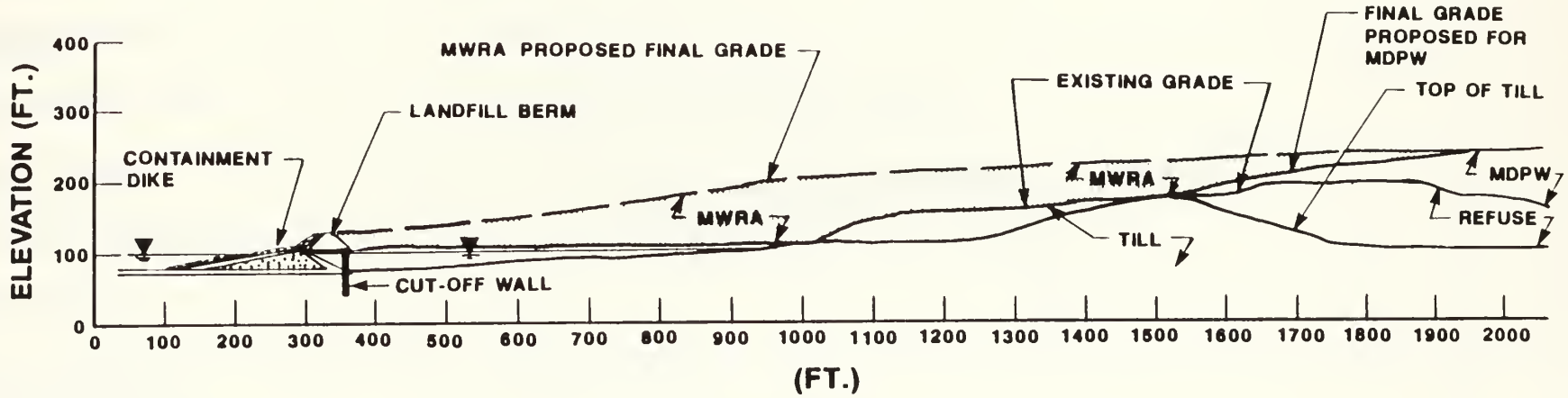
MWRA JOINT USAGE -
LANDFILL AND PHASE I CELL LOCATION

SCALE: AS SHOWN JULY 1989

FILE NO.10264-00

FIGURE 13

FILE NO.10264-00



SECTION B - B

NOTE: SEE SECTION LINE, FIGURE 13

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FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

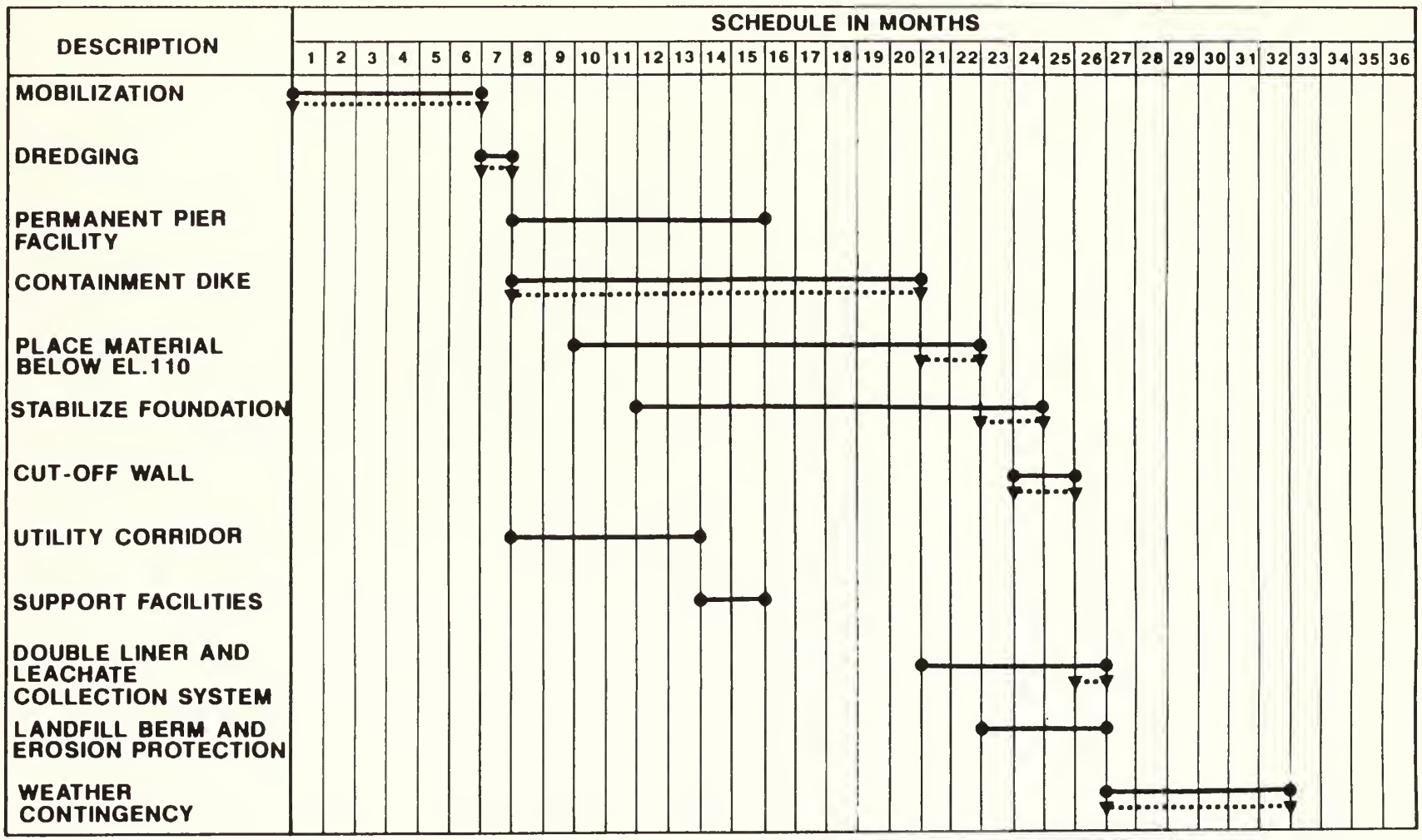
MWRA LANDFILL
SECTION CONTAINMENT FACILITY OPTION

SCALE: AS SHOWN

JULY 1989

FIGURE 14

FILE NO.10264-00



CRITICAL PATH ▼·····▼

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Consulting Geotechnical Engineers, Geologists and Hydrogeologists

FEASIBILITY STUDY
SPECTACLE ISLAND
BOSTON, MASSACHUSETTS

MWRA JOINT USAGE -
PHASE I CELL SCHEDULE

SCALE: AS SHOWN

JULY 1989

FIGURE 15

APPENDIX A

FEASIBILITY STUDY MILESTONES

APPENDIX A

FEASIBILITY STUDY MILESTONES

22 March 1989	Notice to Proceed
27 March 1989	Initial Meeting with MWRA
30 March 1989	Initial Meeting with MDPW
11 April 1989	Spectacle Island Site Visit
14 April 1989	Joint Meeting with MWRA and MDPW
4 May 1989	Walpole Representatives Meeting
17 May 1989	In-Process Review with MWRA and MDPW
5 June 1989	MWRA Internal Review Preliminary Draft Report Submitted
15 June 1989	Meeting with MDPW
16 June 1989	Review Meeting with MWRA
23 June 1989	Draft Report Submitted
7 July 1989	Project Report Submitted

APPENDIX B

Sources of Information

13. Central Artery (I-93)/Third Harbor Tunnel (I-90) Project: Final Conceptual Design Report: Materials Disposal System, June 1989, Prepared for Massachusetts Department of Public Works by B/PB.